ON THE COVER

A RELATIVELY new way of applying paint is to roll it on, as shown on the cover. Small rollers are dipped in a can to renew the supply as needed, while the larger model illustrated receives a steady flow of paint through a hose leading from a container that is kept under air pressure.

The first improvement upon age-old conventional brushing was the spray gun, also air-actuated. The latter reduces the cost but is objectionable for inside work where it is not feasible to use a booth to collect flying spray. The roller overcomes this shortcoming, applies an even coat that is said to show no marks, and is speedy. The pressure-fed model eliminates repeated dipping, which is said to consume 12 percent of the brush-painter's time. Rollers can be used only on flat surfaces, and a brush is still required to reach corners and irregular openings such as areas between shingles.

The new tool consists essentially of a perforated inner roll covered with a woven-pile wool cylinder that can be removed and washed. A dip-type roller was introduced several years ago by Sherwin-Williams Company. More recently, Rubberset Company, Newark, N. J., which has made brushes since 1873, developed one with a paint reservoir in the handle, as well as the air-fed model pictured.

●

IN THIS ISSUE

THE technique of television is changing so fast that it is difficult to keep abreast of it. However, video reached the bursting-out stage by painfully slow progress spread over a century of effort. The history of this newest Cinderella of the communications and entertainment world is recounted in our leading article, which also explains how TV works.

●

DESPITE inroads by synthetic fibers, cotton still leads all textiles. The world over, its growth and processing employ more people than any other single industry. But the cotton industry is holding its position only by replacing men with machines. Between gin and mill it utilizes various air-powered devices. Page 150.

●

GENERAL ELECTRIC'S bold merchandising venture of putting 2000 of its products and services on view through the medium of a nation-wide train tour is described on page 153.

●

IN A TOWN in Iowa, a man who was about to get in the bathtub turned off the water hurriedly to answer the telephone. Returning, he looked in the tub, saw no water, and was puzzled. The water was there, but not the yellow kind he was used to. Unknown to him, the waterworks had begun to remove the discoloring iron by pressure filtration. Page 155.

●

ARE you up on art? You don't have to be a high-brow to enjoy John Sitton's appraisal of ancient and modern creations. He casts his vote for the functional simplicity of today's designs. Page 157.

Compressed Air Magazine

VOLUME 55 — **June, 1950** — NUMBER 6

EDITORIAL CONTENTS

ADVERTISING INDEX

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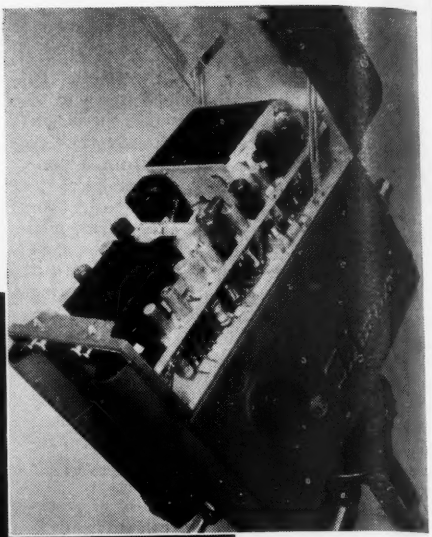
Television Today

More Than a Century of Scientific Endeavor Has Brought Video to Its Present Status

A. M. Brodine



ILLUSTRATIONS FROM
UNLESS OTHERWISE NO

THE TELEVISION CAMERA

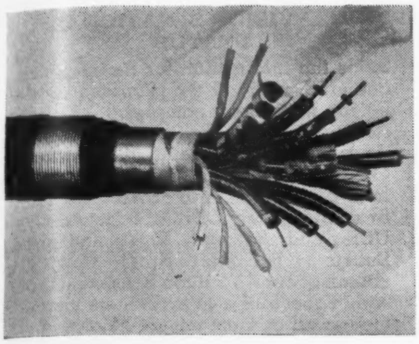
Television cameras, even to those who work with them everyday and fully understand them, are unwieldy, 4-eyed monsters of formidable intricacy. In addition to its complex electronic system, the camera (upper right) has a double optical system. One is for projecting and focusing the optical image on the pickup tube; the other enables the cameraman to view the scene being televised. The cameras are mounted in various ways: on tripods for shooting on location or outdoors, on pedestals to permit height adjustment, and on mobile platforms (above) called "dollies," with the instrument attached to a long boom that can be swiveled to allow maximum movement and adjustment. The cameraman rides the dolly, and a "dolly-pusher" shoves the unit around the set from scene to scene. The microphone (left) for picking up voices and other sounds is also mounted on a boom and dolly and is snaked back and forth just outside the camera's range.

MANY people have come to look upon television as a product strictly of the twentieth century and do not realize that it took more than 100 years of inventive genius, millions of dollars in research, failures, and successes to bring video into their homes.

In 1847 a man named Bakewell invented a method of transmitting sketches over wires. His apparatus involved the use of two revolving cylinders—one to send, one to receive—which rotated simultaneously and were connected by a telegraph line. A metal stylus similar to the needle in Edison's first phonographs described a helical path over each cylinder. On one cylinder was a design coated with shellac which prevented the transmission of electric current when the stylus moved over it. On the other—the receiver—was placed a piece of paper prepared chemically to change color when electricity passed through it. The resultant picture was a negative of the one in the transmitting end—was like a blueprint made from a line drawing. But it was the first-recorded successful effort to send images to distant points.

Refinements by succeeding generations of scientists, engineers, and inventors resulted in modern wirephoto so familiar to newspaper readers. These pictures, however, are stationary, and in order to make television a reality there still remained the difficult problem of transmitting an image of a moving object. Converting a light signal into an electrical impulse at one place and using that impulse to control light at a distant point is a comparatively simple matter so long as a single light signal is all that is required. But in sending a picture of a moving object it is necessary in a very brief interval to transmit many signals varying minutely in intensity.

Any image or picture may be considered as something made up of an extremely large number of small areas dif-



CARRIER CABLE

A typical coaxial conduit showing eight coaxial conductor cables (the larger members) and the secondary conductors that serve to carry control signals and power to television repeater or booster stations. The coaxial conductor itself consists of a single copper wire held in place along the center line of a hollow tube by disk-shaped spacers of insulating material. The free space in the tube is filled with compressed nitrogen to prevent moisture from entering. The whole is enclosed in a multilayer casing having an outer protective jacket of plastic vinyl-chloride or lead.

SURGE IN SET PRODUCTION

Compared with a prewar total of not more than 15,000 receiver sets in service in the United States, the 1949 production closely approached three million units, and makers predict an even higher output in 1950. The receiver cabinets shown above are being inspected prior to assembly at RCA's Camden, N. J., plant.

fering in brightness, for that is the way the eye sees things. When an image is viewed by the human eye, the rods and cones of the retina—the eye's light-sensitive screen—break it up into small elements, and the many fibrils of the optic nerve simultaneously send to the brain the impulses set up by the light in each of the rods and cones. All television systems so far developed perform a similar kind of point-by-point image analysis called "scanning," but the varying degrees of light and shade are transmitted in sequence and not simultaneously.

The first man to invent a successful scanning device for breaking up an image into a series of points of light was a Russian, Paul Nipkow, who did his work in Germany. In 1884 he was awarded German patent No. 30105 for a means of conveying the illusion of motion over wires with electricity. The basic innovation in his apparatus was a scanning disk, a circular plate punctured with holes arranged in a spiral. When the disk revolved, a lens system behind it picked up, in a sequence of dots, the light reflected from an object. The dots of light were, in turn, converted into electrical signals and sent over wires.

Nipkow's idea was basically sound, but in those days there was no radio with which accurately to transmit and receive the image, and the photoelectric cell, the audion vacuum tube, and many other modern electronic devices were still unknown. So his equipment turned out to be too crude for the job which had to be done. However, television experimenters were still using his whirling disk for scanning as late as 1933.

J. L. Baird of Great Britain is credited with having demonstrated the first really workable video system in January, 1926. The latter, which used an improved Nipkow disk as a scanner, was highly complicated, and some parts of it revolved at 800 rpm. The Radio Corporation of America, which had spent hundreds of thousands of dollars on television research, also had developed a successful system based partly upon a mechanical disk and partly upon electronic movement of the image.

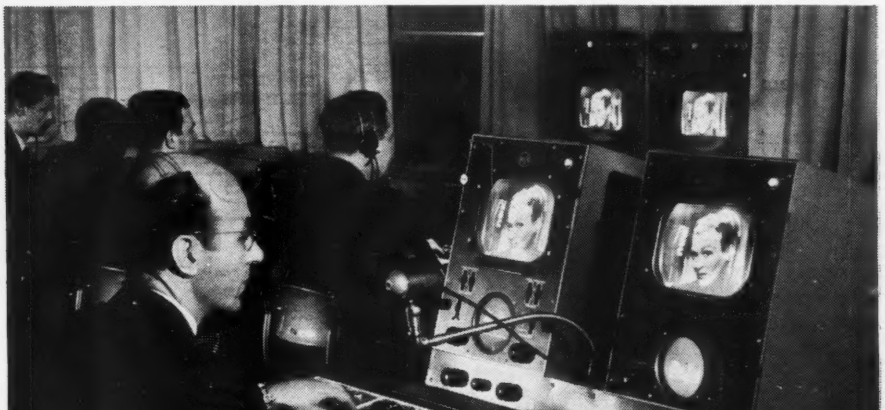
Dr. Vladimir K. Zworykin of the RCA laboratories is sometimes called the father of modern television because of his many contributions to the apparatus as we know it today. Still, as late as 1930, most experimental video cameras and receivers were a maze of moving mechanical parts and electrical controls which were too crude to induce the myriad, minute fluctuations demanded of a commercially acceptable system. The main difficulty lay in overcoming the inertia of the moving parts.

Under present United States standards it is necessary to send 30 complete picture-images a second. Just what this means can be clarified somewhat by the following comparison: a 3x5-inch halftone of the kind reproduced on this page requires but one printing per image to be seen as a complete picture and is made up of 150,000 dots. A television image, if formed in exactly the same way, would

GOING ON THE AIR

Putting a television show on the air requires the combined efforts of many people, including engineers and artists, cameramen and carpenters, directors and dolly-pushers, authors and sponsors. The program goes through a control room, where camera control men, called shaders, watch monitor screens and regulate the quality and brightness of the picture. The director watches other monitors, one for each camera, and calls out the number of the camera he wants used at the moment. Then the program goes through the master control unit (right) which is the dispatch point for the show. Beyond that is the "system monitor" with the show being broadcast to the public, and beyond that the atmosphere with all its tricks and foibles and the horizon beyond which television signals cannot go.

NATIONAL BROADCASTING PHOTO



TELEVISION'S NATIONAL STATUS

Since the information for the map was gathered, many of the proposed installations have been completed. Expansion in 1949 established network service between Cincinnati and Columbus, Ohio; from Toledo to Dayton, Ohio; from Boston, Mass., to Providence, R.I.; from New York City to Schenectady, Utica, and Syracuse, N. Y.; and from Buffalo to Rochester, N. Y. Now, 28 million of our 43 million households are within reach of a television station, although all of them do not have sets.

call for 9,450,000 dots of varying intensity every second to be seen as a complete picture. That many variations per second is asking a great deal of any moving mechanism, but early experimenters thought they could satisfactorily overcome the difficulties. As a matter of fact they couldn't, but they did establish a point of primary importance to television: that moving images could be sent by radio or telephone.

Philo T. Farnsworth was a 14-year-old student in a rural Idaho high school when he first outlined to his science teacher the ideas he eventually incorporated in a completely electronic television system of the type now in use. Until that was done television would remain a laboratory gadget "doomed to failure," said the boy at the time. It took him more than thirteen years and more than a million hard-to-raise dollars to reach the stage where, in 1930, he was awarded U.S. patent No. 1,773,980 for his system of television transmission and reception. The application was filed in the Patent Office in 1927 and made basic claims for video signals produced electronically, the rights to which were contested by Zworykin. After hunting up his Idaho science teacher, Farnsworth finally established his priority; but his patent, earned with such difficulty, expired on August 26, 1947.

In England, Baird, working along the same lines as Farnsworth, devised a highly efficient current amplifier to raise the feeble current fluctuations in the video pickup tube to usable levels. In 1928, Zworykin had demonstrated a pickup tube he called the Iconoscope. Later—in 1939—RCA and the company founded by Farnsworth entered into nonexclusive agreements which allowed each to use the other's television inventions.

After the first receivers were placed on sale in 1939, a few stations began sending regular programs. Initially, video sets would pick up only the picture, and a regular radio had to be used to capture the accompanying sound. Developments in commercial television were halted during World War II, but by 1947 the demonstrated technical reality had become an established sight-and-sound broadcasting service. Networks and radio relay systems were spreading slowly across the country, and as early as 1947 the American Telephone & Telegraph Company initiated plans to have coast-to-coast facilities in operation by 1950. At the end of 1947, eighteen commercial stations were in service, and FCC regulations then permitted an estimated 400 stations on the thirteen channels set aside for video broadcasting. Of these, Channel 1 was reallocated in 1948 for experimental work and government test purposes, reducing to twelve the number available to the public.

Today's cameras are a great improvement over the Farnsworth and Zworykin models, and this is especially true of their "eye's" response to light. When Baird first demonstrated television in England, his subjects had to be illuminated so brightly that only dummies could be used because humans couldn't stand the heat and glare. The Image Orthicon, the most sensitive of the several pickup tubes now in general service, is more responsive to light than a motion-picture film and will operate at a mere 50 foot-candles, an intensity just slightly above that required for reading books and magazines.

The secret of the light-sensitive tube is a phenomenon known as photoelectric emission, which gets its name from the fact that nearly all conductors give off some electrons when exposed to light. Certain materials such as cesium, cesium oxide, antimony, and silver are very ac-

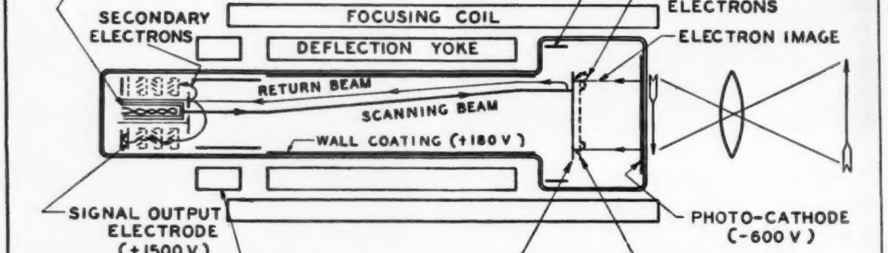


IMAGE ORTHICON

A simplified cross-sectional diagram of the most sensitive of the several television pickup tubes now in general use. In operation, the scanning beam is projected from the cathode at the extreme left toward the target at the right, on which electrical charges have been built up by focusing an optical image of the scene on the photocathode (extreme right). The scanning beam is given just enough velocity to reach the target. If the electrons in the beam strike a positive charge, they are absorbed. If the target charge is negative, electrons in the beam are returned to the area near the cathode. There they strike an "electron multiplier" that gives off "secondary electrons" under the impact of the "primary electrons" from the return beam, thus greatly increasing the number of electrons. In this way the current carrying the picture to the transmitter is greatly amplified.

tive in this respect, and varying combinations of them form a complex chemical coating for a plate (the photocathode) at one end of the camera's "eye."

An ordinary camera lens is used to project optical images on to one side of the Image Orthicon's light-sensitive plate, while the opposite side of the plate gives off electrons in direct proportion to the light and shade on the subject being televised. The electrons thus emitted are focused on a thin glass target and are caught by and "stored" in a target screen which is close to and on the lens side of the glass target. In this way the picture picked up by the camera is not only formed electronically but is also stored much like the charge in a battery. It is this storage principle which makes tubes of the Image Orthicon type so sensitive.

To make the variable light signals available in sequence at the receiving set, the Image Orthicon requires scanning the same as the older, mechanical disk devices. This, too, is effected electronically and is done very rapidly. At the tube end farthest from the light-sensitive plate a stream of electrons is released and directed at the glass target. Pulsating magnetic fields bend the electron stream steadily and speedily from left to right and then allow it to fly back to its starting position. At the same time another set of magnets displaces the beam vertically, causing it to move at a much slower rate from top to bottom and then return rapidly to the top position.

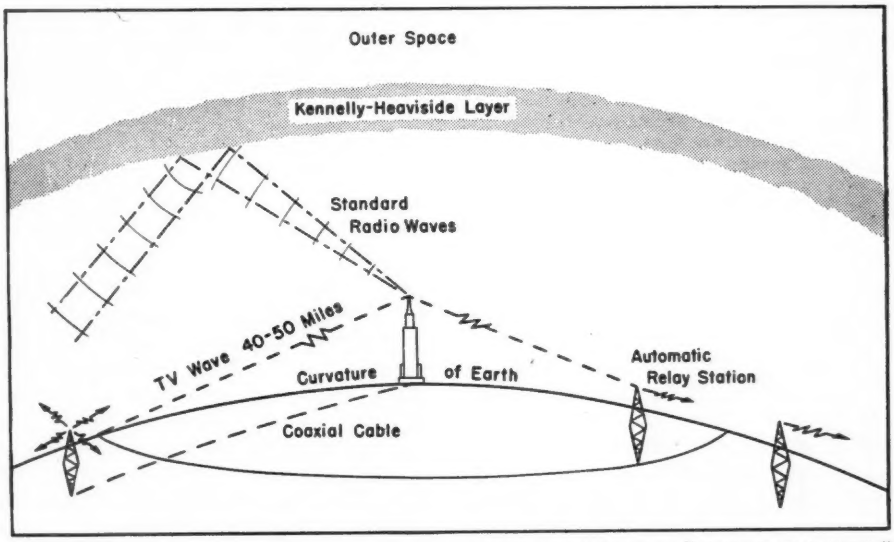
With the camera in operation, there is an interchange of charges between the two sides of the glass target. The electron image from the light-sensitive plate falls on one side of the target while the other side is scanned by the electron beam. As the latter sweeps the target it removes the stored charge on the meshed screen like a vacuum cleaner picks dust from a rug. Of course, the light image immediately starts to deposit more "dust," so the process is continuous. The television signal is obtained from the varying electron stream turned back from the target to a "collector," where the signal is greatly magnified. Altered by the stored charge in the screen, the return beam results in a fluctuating current which is used to modify the radio waves that carry the program out over the air.

When television signals leave the transmitter, they refuse to follow the curvature of the earth. Therefore, in order to distribute TV programs throughout a wide area, network facilities are an absolute necessity. High buildings such as the Empire State in New York City help to increase the effective range, but the shape of the earth is still a limiting factor. In designing these facilities, engineers have done for video what Nature does for radio—bounce the waves across the country. Two ways by which this can be done have been explored.

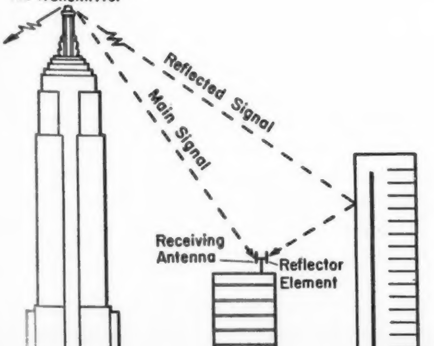
One means of transmitting television is the coaxial cable, which so far seems to be the only continuous physical structure by which the band width needed for television transmission can be carried long distances. It can conduct electromagnetic waves covering an extremely wide band of frequencies, thus enabling it to handle television images, or as many as 200 telephone calls simultaneously. One of its great advantages is that it offers an almost perfect shield against the escape of signals and against external interference. Although the cable absorbs some power in carrying the high-frequency waves required by TV, serious loss in signal strength can be offset by amplifiers, known as repeaters, installed every 5 to 7 miles. The other method, which is also satisfactory, involves the use of directed ultrahigh-frequency radio waves relayed periodically by means of stations located about 25 miles apart on hilltops or other high points so obstructions won't intercept the radio beams.

By 1949, fifteen major communities in the United States had been linked by either coaxial cable or microwave relay stations. At first two networks were formed of groups of cities—Boston, Schenectady, New York, Philadelphia, Baltimore, Washington, and Richmond on the east coast and Milwaukee, St. Louis, Detroit, Toledo, Cleveland, and Buffalo, based on Chicago, in the Midwest. In January, 1949, these independent circuits were tied together by a coaxial cable connecting Philadelphia and Cleveland by way of Pittsburgh. Since then the Bell System has nearly doubled its facilities, the hookup consisting of 25 cities and close to 9000 miles of circuits. By the end of this year, when the work of extension south and west into new areas is completed, AT & T's network will total 43 cities and 15,000 miles of circuits.

But when the joining of the Atlantic and Pacific coasts will make transconti-

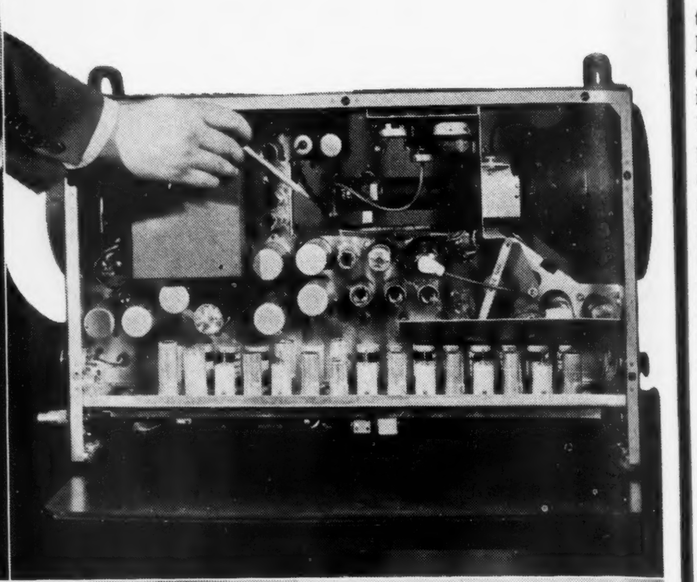


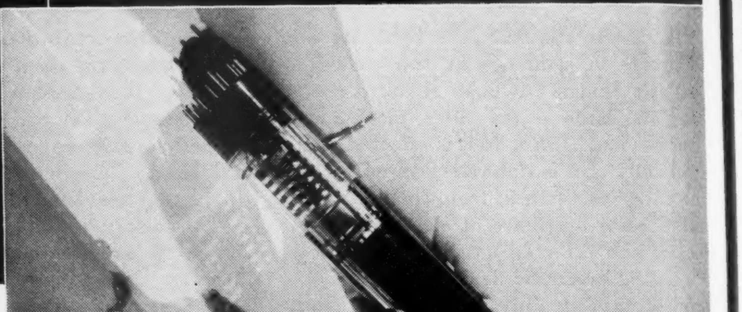
DRAWINGS ADAPTED FROM "ARCHITECTURAL FORUM"



HOW TV WAVES BEHAVE

As shown in the diagram above, direct television reception is limited by the curvature of the earth unless the video signal is relayed to points beyond the horizon either by coaxial cable or radio relay stations. The reason for this is that TV signals are transmitted on radio carrier waves that are shorter than standard-band radio signals. Standard radio waves are reflected, like light from a mirror, back to the earth by an electrically charged stratum of the atmosphere called the Kennelly-Heaviside Layer, after the men who discovered it. Video signals are too short to be reflected by the layer, and if sent upwards would mostly pass on through it. However, television signals are usually directed beam-fashion to make use of a high percentage of the original signal. Network systems permit television programs to be broadcast over a wide area without being restricted by line-of-sight reception. Ghosts in television are real. Sometimes a part of the video signal is reflected from surfaces near the receiver (sketch at left). Because the reflected signal has to travel farther than the one that comes right from the transmitter it arrives just late enough to create a secondary, out-of-register image. Actually, when a "ghost" appears on the screen, the image is no longer television, but television and radar combined.





INDUSTRIAL TV EQUIPMENT

An industrial television system recently introduced by RCA consists of only two units: a camera about the size of a 16-mm. movie camera and a master control unit, standing on the table above, no larger than a suitcase. The apparatus produces pictures of excellent quality, as the unretouched photo reproduction shows. The image on the screen has been transmitted to the master control unit by the camera on the tripod at the right. The Vidicon pickup tube that serves the system is compared at the right with the Image Orthicon, a larger tube widely used in commercial telecasting. The tube side of the master control unit of the industrial system is pictured at the top-right. The array of tubes at the bottom of it is the video signal amplifier.

nental television a reality is still a matter of speculation, with guesses ranging from two to four years. Work now in progress will provide radio relay circuits as far west as Omaha and beyond, but long before that is accomplished a circuit between Chicago and New York will be in operation. The inference is that the first link between New York and the Pacific Coast will be by radio relay instead of coaxial cable, though the latter will form an integral part of the entire network.

In order to pick up video broadcasts at any point some distance from a transmitter, it is necessary to have a special antenna connected to the receiver. Experts believe that, as the transmitting power of television stations increases and receiving sets become more sensitive, an antenna built directly into the set will give as good a reception as the familiar dipole, a mast-like structure which is, in fact, two antennae: a small top "H," which handles high frequencies (channels 7 to 13) and a larger bottom "H" which picks up low frequencies (channels 2 through 6). More complicated than the copper wire strung for radio, it requires special lead-ins consisting of either tapelike conductors or coaxial cable. To increase the reception distance and to overcome blocking and interference, high antennae are preferable. No average height can be prescribed, however, because an installation that won't work one place is fine in another.

When the antenna picks up the electrical impulses broadcast by radio carrier waves they are weak and have to be amplified by means of radio; but it is the cathode-ray tube that puts vision into television. Consisting of a black, cone-shaped tube, it has the appearance of a chemist's flask and is, in effect, a motion-picture theater in a tube. At one end of its long narrow neck there is an electron generator—a cathode that serves as a projector, and at the opposite end is a round, luminescent screen. The generator sprays electrons like water from a hose through a series of anodes which, like metal "lenses," cause the electrons to form a sharply focused beam and, because of their high positive voltage, give them tremendous velocity. As the electrons are propelled toward the screen they pass through the pulsating electromagnetic field of a yoke fitted around the neck of the cathode-ray tube. Finally, following a carefully prescribed path, they hit the screen, which is coated with a chemical that fluoresces in proportion to the intensity of the electron stream. The yoke controls the direction of the beam, sweeping it rapidly across the screen, the same as the original image is scanned in the television camera.

Unlike the motion-picture screen, the television screen actually never has a complete picture on it at any time; there is just a single pin point of light on it at any given instant. It is from the sequence of these pin points of light, which continually vary in brightness and position as they sweep across the screen, that

the picture is constructed in the mind. Physiologists say the human eye doesn't change at once in response to a change in light intensity, but has a lag of about 1/10 second. This lag keeps the impression of light before the mind, and if another properly planned signal is directed through the eye before the 1/10 second interval has elapsed, the person looking at the two separate signals gets the impression of continuous light. This is the so-called persistence of vision which makes possible not only video but motion pictures as well.

The main difference between movies and television is the way in which the image is formed. In the case of the motion-picture projector, the image is thrown on the screen for a fraction of a second. Then the shutter cuts off the light, the film moves down to the next frame, the shutter opens, and the cycle is repeated. In other words, there is a light period and a dark period. In video the picture also consists of a certain number of images per second but the successive images are formed so quickly that there is practically no dark period between them.

The complex actions which go on silently and with no moving parts inside the cathode-ray tube are incredibly fast and accurate. Present standards for U.S. television are based on a 525-line image at the rate of 30 images per second. But the latter are made up of 60 half-images. At the beginning of the cycle, the luminous beam travels down the screen in a zigzag path, forming lines one, three, five, seven, nine, and so on—all the odd lines from one to 525 inclusive. This takes 1/60 second. Then the spot leaps back to the top and forms all the even-numbered lines from 2 to 524 inclusive. This takes another 1/60 second. Keeping in mind the fact that the brain retains a visual impression for about 1/10 second, it is easy to see why the television image, though made up of a continually varying stream of electrons which causes only one dot of light to appear on the screen at a time, gives the spectators the impression of a continuous picture.

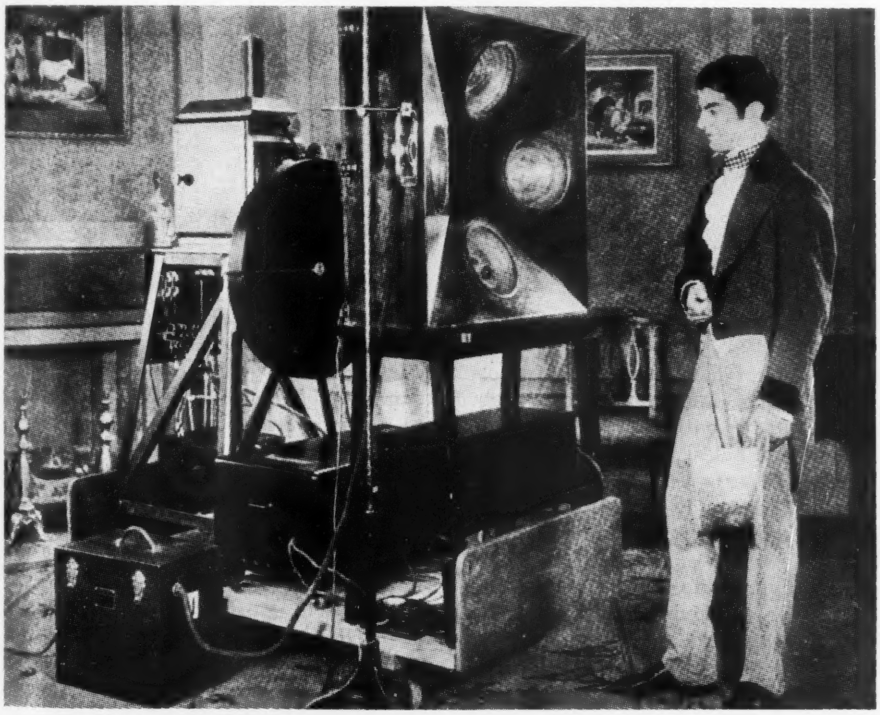
The cathode-ray tube was produced in Germany in 1897 by Karl Ferdinand Braun, but 25 years ago it was still a laboratory tool that had to be imported at a cost of about $500. Farnsworth used a home-made version of it in his first sets, and Zworykin and Allen B. Du Mont were pioneers in refining it for television. Little more than eighteen years ago even the basic materials required to fashion the tubes were not available commercially. But today the story is different, for major glass companies have millions of dollars invested in equipment to supply the glass blanks from which they are made and a sizable industry has sprung up to provide the necessary fluorescent chemical.

One of the newest cathode-ray tubes has a glass faceplate and a glass neck sealed to a metal cone. The Du Mont company now builds a 20-inch-screen tube only 19 inches long, or 11 inches shorter than the older models for the same screen size. The resultant advantages are smaller television cabinets, less floor space, lower cost, and lighter weight. But all-glass tubes are still used exclusively in the popular 10-inch-screen sets. Dozens of factories are producing the magic eyes and selling them by the hundreds of thousands for a fraction of what they cost less than twenty years ago. In addition, the new tubes last more than 1000 hours, as compared to the 30-hour life of the earlier types.

Besides being a medium of entertainment, video fills an important part in the scientific and industrial realms. One of its applications is that of observer in places where human beings cannot go because of inaccessibility or dangerous conditions. During the atom-bomb tests at Bikini, for example, cameras were set up on an atoll where the risks involved excluded man. The pictures taken were transmitted to planes and ships remote from the scene of operations, where the explosion could be closely watched with safety.

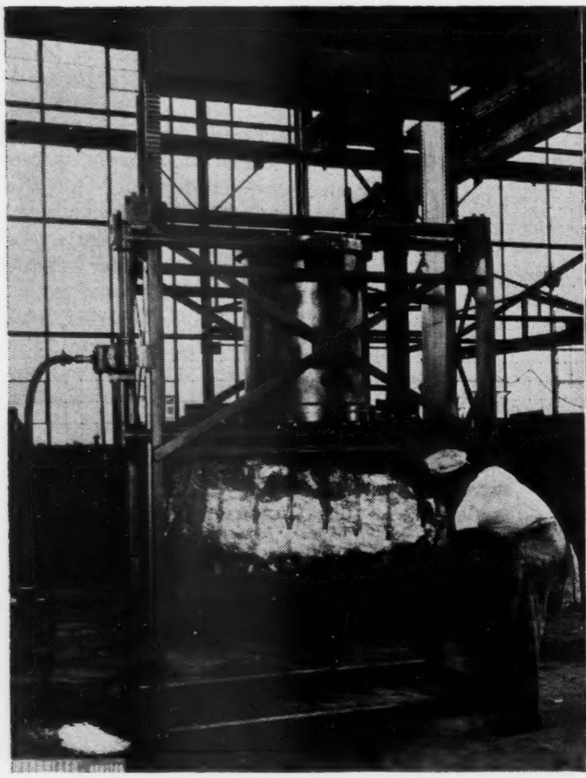
A less spectacular use might be found for television in natural-gas fields as a sight-and-sound monitor for automatic compressor stations. Cameras could be installed to give pictorial records of machinery and equipment, or gauges and meters, so men at remote points would know that they were operating as they should. The cameras, incidentally, would not have to be as complex as those used for studio shooting, and in all probability the televised signal will be sent by cable, thus dispensing with a transmitter. Recently, Du Mont announced a closed-circuit system whereby intercity conferences or conventions could be held by television with all the principals appearing on the screen for the audience to see but remaining in their home offices.

But even as a source of entertainment, video is nothing to be sneezed at. A total of 2,750,000 sets was produced in 1949, and manufacturers and distributors estimate that the 1950 output will number between 3½ and 5 million receivers. By 1953 television will, industrial leaders predict, have a national audience of 75,000,000 people. If that should come to pass, every other person in the United States will be a telefan; and, as one commentator has put it, "From a century that has produced the auto, the airplane, and the atom bomb, television may emerge as the greatest single phenomenon." At any rate, there seems to be no doubt, as there was in the case of the horseless carriage and of the flying machine, that TV is here to stay.

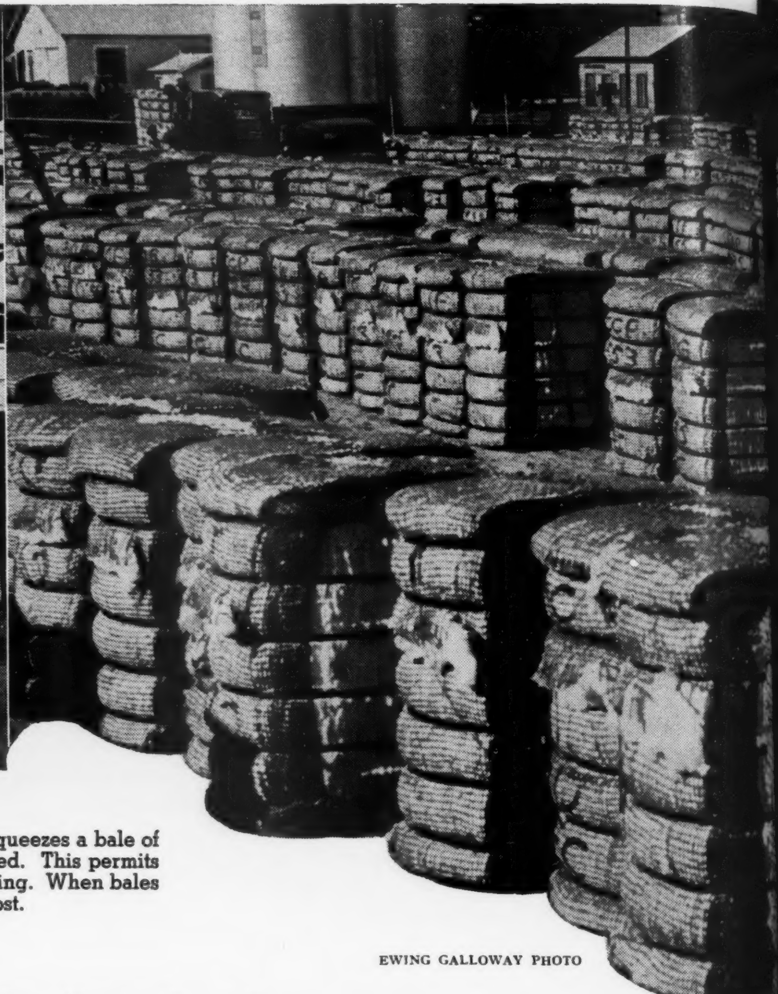


TELECASTING TWENTY YEARS AGO

An actor standing in front of a 1930 television camera. The black circular drum at the left is the scanning disk, perforated with holes arranged in a spiral. An arc lamp behind it supplied light for the flying scanning spot, which rapidly traveled back and forth over the subject. The framework the actor is facing holds a bank of photoelectric cells that translated the light signals from the flying spot into electrical impulses. Eventually, all the whirligigs were abandoned in favor of an all-electronic system, but not before it was proved that television was not just an impractical dream.



DINKEY PRESS
Operated with either steam or compressed air, this press squeezes a bale of cotton so that the metal straps that bind it can be unbuckled. This permits salvaging the bands in their entirety for further use in rebaling. When bales are opened by breaking the buckles some of the metal is lost.



EWING GALLOWAY PHOTO

PRODUCT OF THE GIN
A yard of the Kingsburg Cotton & Oil Mill Company in California showing flat bales, each girdled by six steel ties, awaiting shipment. Much of the nation's supply of long-staple cotton, formerly imported from Egypt, is now grown in our Southwest.

King Cotton Goes Mechanical

Long Reach Machine Works Introduces Air-Powered Devices to Cut Cost of Gin-to-Mill Handling

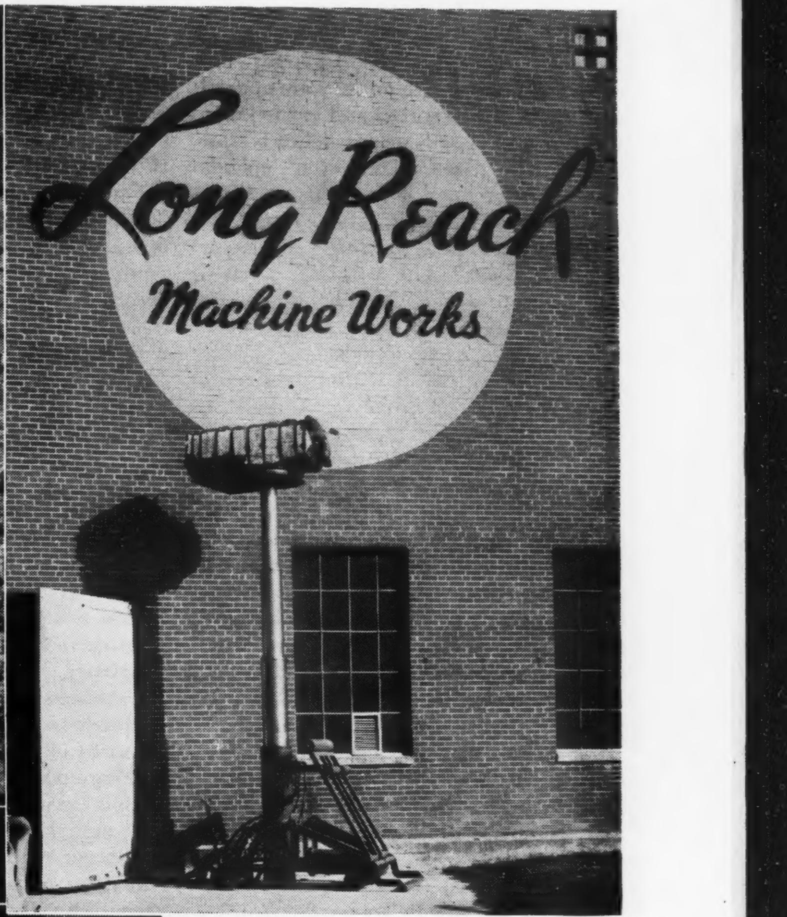
C. H. Vivian

SPURRED by the necessity of cutting costs to retain its title of king of the textile world, the cotton industry is turning to mechanization all the way from field to mill. Machinery now performs functions ranging from picking the snowy fiber to speeding up the multitude of steps by which it is afterwards converted into myriads of useful products. The raising and processing of cotton probably involve more people than any other single industry. In America, around 850 counties in nineteen states grow the staple, and approximately eleven million persons are concerned with it from the time it is planted until it is baled for shipment to factories that process it. Still more millions are affected by the latter operations.

In recent years the cultivation of cotton in the United States has been shifting westward. According to the Department of Agriculture, Texas, Arizona, New Mexico, and California produced nearly half the nation's 1949 crop of sixteen million bales. In contrast, the Old South—the states east of the Mississippi River that formerly represented the cotton center of the world—raised only about 30 percent of the total. A leading reason advanced for the shift is that conditions for employing machinery in all growing stages from planting to harvesting are more favorable in the semiarid West and Southwest than they are elsewhere.

Cotton raising has, traditionally, been a leisurely pursuit. As one writer recently expressed it, "Folks have long known that if you want to make cotton, you have to have a man at one end of the plow and a mule at the other." Now the old order is changing. Tractors are fast supplanting mules, and men are being eliminated. It is estimated that completion of the mechanization program now underway in the plantation area of the Mississippi delta alone will replace some 200,000 persons. The Old South is at a disadvantage in this movement because it is an area of relatively small individual farms manned in large part by sharecroppers. When cotton-culture migrated westward, it went in for larger tracts of land where machinery shows to advantage. Now, whether it wants to or not, the Old South must mechanize if it is to continue to raise cotton.

Between the field and the processing mill cotton undergoes several handlings that likewise have always been done by easy-going methods and called for the generous use of manpower. There, too, mechanization is stepping in. The necessity for this is explained by J. T. Stockton, Jr., of the Long Reach Machine Works, Houston, Tex. His concern constructs and maintains machinery for the parent firm, Anderson, Clayton & Com-



AIR-POWERED STACKERS

The telescoping unit seen above will lift a bale of cotton up to 20 feet. When lowered, it will pass through an ordinary doorway. The kicker-stacker, left, will handle 200 bales an hour and can be used for warehouse stacking or for loading bales into trucks or railroad cars. The bales shown in these pictures are of the high-density type for export shipment. Each is secured by nine steel ties and weighs approximately 500 pounds.

pany, and also builds some equipment for sale to other cotton handlers. Anderson, Clayton & Company is the world's largest cotton merchandiser. Its buyers, stationed throughout the cotton-growing sections of the United States, Brazil, Mexico, Argentina, Peru, Paraguay, and Egypt, have purchased on an average 2,250,000 bales annually for the past twenty years. The company's domestic and foreign subsidiaries own numerous gins, compresses, warehouses, and oil mills.

"Until recently," said Mr. Stockton, "few changes had been made in the methods by which cotton was handled for 30 years or more. A typical worker used to get 25 or 30 cents an hour, so we 'laborized.' Now wages run around \$1.10 an hour. A man makes \$44 in a 40-hour week. Consequently, the current trend is toward mechanization. In line with this movement, equipment and methods are being studied with a view to improving them for faster operation or for operation without so much labor." Studies are disclosing that some of the work is of such a character that it can be done best with pneumatic machinery. Long Reach has already applied air power to several of its devices, and further investigation will probably increase the number because the firm's designing engineers are at the moment distinctly air-minded.

The handling of cotton begins at the gin, which has changed little in operating principle since Eli Whitney invented it in 1792. As picked, the crop consists roughly of 2 pounds of seed to 1 pound of fiber. In the gin they are separated when rapidly revolving teeth on circular metal disks pull the fiber through slits that are too narrow to admit the seeds. The efficiency of these machines has recently been improved so much that approximately 8400 gins in the nation now handle more cotton than 12,000 did in 1938.

Ginned cotton is placed in a press box and compacted by means of hydraulic rams. When enough has been compressed to make a bale, then burlap or jute bagging is drawn over it and it is securely bound by six thin, mild-steel strips the ends of which are held together by what are known as arrow buckles. Each band is $\frac{7}{16}$ inch wide and 15 feet long and is called a standard cotton tie. The product of the gin press is termed a flat bale. It measures 54x27x45-48 inches, weighs from 500 to 525 pounds, and

has a density of 12-14 pounds per cubic foot.

These bales are shipped to larger concentration centers where they are opened and the cotton is sorted and graded into the various classifications required for different purposes. The value depends chiefly on the fiber length ($\frac{7}{8}$- or $\frac{15}{16}$-inch is called standard staple) and the grade (determined primarily by color and cleanness). The bales are opened either by breaking the buckles or by squeezing them in a "dinkey" press so that the ties can be loosened at the buckles and removed without reducing their length. The dinkey press is ordinarily operated with steam at a pressure of 125 psi., but compressed air serves when the steam plant is shut down.

In order that the bands may be suitable for reuse on the bales of graded cotton, they are straightened by running them through rollers. They are next cut into measured pieces, two of which are riveted together to form straps of the length needed to fit the new bales. The work of cutting was formerly done by a foot-actuated shearing machine, which Long Reach has now converted to air operation. Thus powered, it will cut from 8 to 10 strips at one stroke with an expenditure of only $\frac{6}{10}$ cubic foot of compressed air. A foot-controlled riveting machine has been similarly redesigned. It will handle six bands per minute with an air consumption of about 2 cfm. and is provided with die blanks for applying 1, 2, 3, or 4 rivets, as may be required to give the strap joint sufficient strength for its particular purpose. In addition, an electric riveter is available, but it is more costly to run than the air-operated machine.

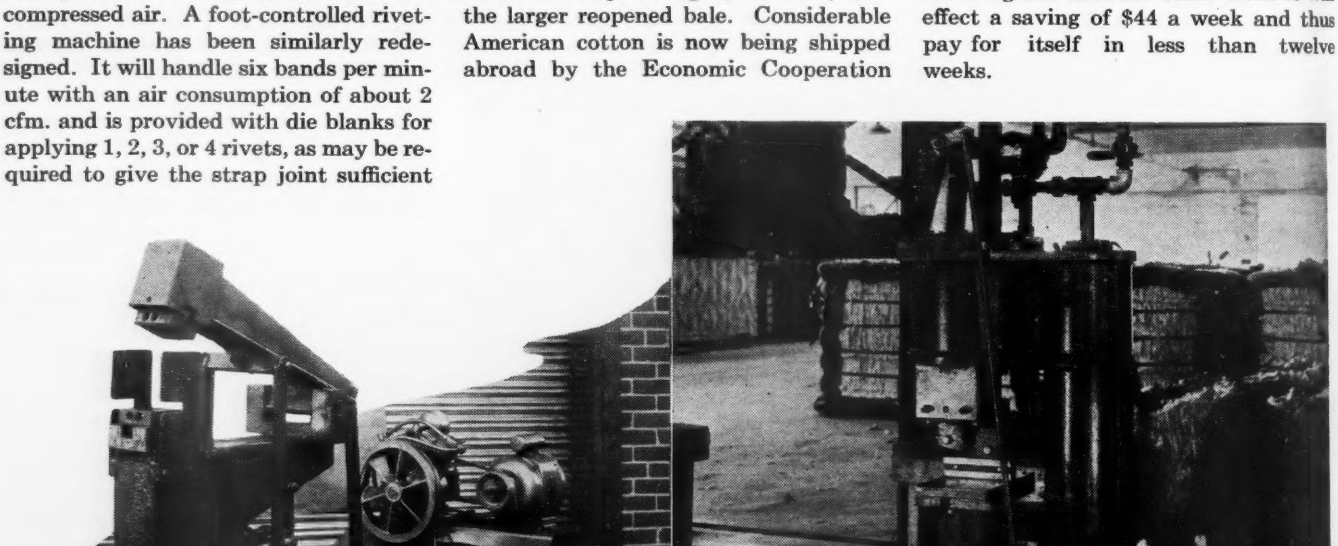
The re-formed bales of graded cotton, called standard bales, are smaller than those that come from the gin but weigh the same. Each measures approximately 56x28x18-22 inches, contains about 25-30 cubic feet, and has a density of 23-30 pounds per cubic foot. It is bound with eight instead of six ties but, because the bales are shorter, they can be made up from the original straps, as already mentioned.

Although all cotton consigned to domestic processors is shipped in standard bales, staple for export is usually rebaled into a still smaller package. Known as a high-density bale, it is approximately 59x24x19 inches in size, contains around 16 cubic feet, and has a density of 32-40 pounds per cubic foot (about the same as that of pine wood). Because more of the latter can be placed in a truck, boxcar, or freighter, rebaling sometimes saves as much as \$5 a package in transportation charges and costs only about \$1.50. The procedure followed in making up high-density bales is the same as that already described. Each is bound with nine straps salvaged, as before, from the larger reopened bale. Considerable American cotton is now being shipped abroad by the Economic Cooperation Administration of the Federal Government.

Two other air-operated Long Reach products are a telescoping stacker and a kicker-type stacking machine, both of which are designed to handle the heavy bales of cotton with speed and a minimum of muscular effort. The first-mentioned unit does the same work as a lift truck, and its platform can be quickly elevated to a height of 20 feet. The kicker machine will either stack bales in a warehouse or load them into a truck or railroad car.

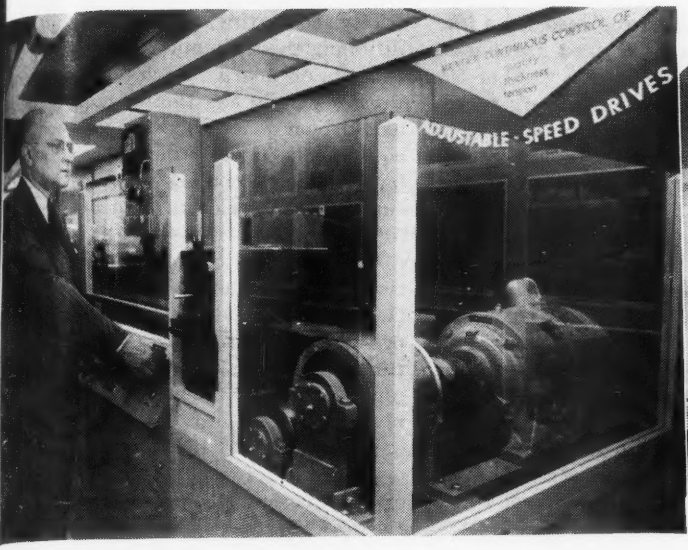
All these air-powered units are built to use air at 100 psi. pressure. For service at points where there is no air-supply system, Long Reach operates them with air furnished by a compressor of suitable capacity—an Ingersoll-Rand air-cooled model complete with storage tank and arranged for either motor or gasoline-engine drive. A $\frac{3}{4}$-hp. size is usually furnished for the purpose.

Bales of cotton are weighed on a beam-type scale that needs one man to operate it and another to handle the bale. Long Reach is now preparing to do the latter job with an air-powered device. The added cost, including an air compressor, will be about \$525. But by releasing one man for other work it will effect a saving of \$44 a week and thus pay for itself in less than twelve weeks.

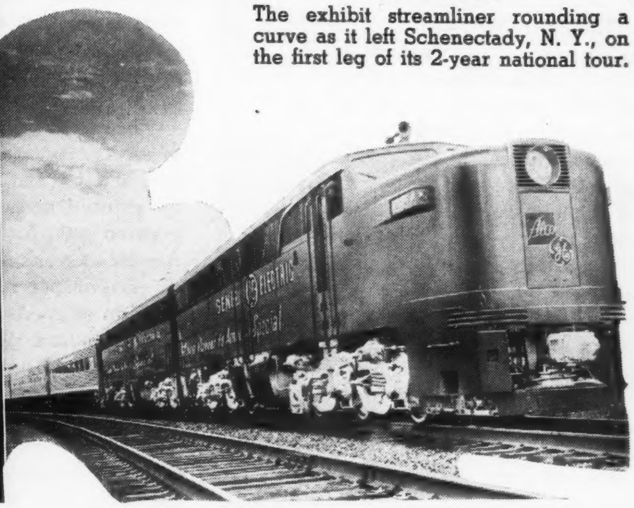


SHEAR AND RIVETER

Steel bands removed from bales of cotton are re-formed into shorter ties with the aid of these machines. Both were built for foot operation (note pedals) and afterward converted to air power. The unit at the right is a shear that will cut 8 to 10 bands at a time. The other device rivets pieces together to form ties of the desired length for any of the three sizes of bales. Shown on the truck with it is an Ingersoll-Rand motor-driven compressor that is supplied to operate the riveter and other air-powered devices when they are to be located where air-distribution lines are not available. The bales in the background of the view at the right are of the large flat type that come from the gin and are bound with six straps.



STEEL-MILL DRIVE
A working exhibit of a strip rolling mill in which high acceleration and fast braking are provided by amplidyne-controlled direct-current drive. Tension, direction of rotation, and speed of the strip, which may range from 60 to 1500 feet per minute, can be regulated by the visitor. Thickness is indicated by a beta-ray gauge. A detection unit flashes a signal when a hole in the strip passes it. K. H. Runkle, manager of the Industrial Divisions, General Electric Apparatus Department, is shown at the controls.



EN ROUTE
The exhibit streamliner rounding a curve as it left Schenectady, N. Y., on the first leg of its 2-year national tour.

Industrial Showcase on Wheels

General Electric Company is Taking 2000 of Its Products and Ideas on a National Tour

EFFECTIVE display of goods has long been recognized as one of the most potent aids to merchandising. Retail establishments devote much time and money to creating eye-appealing exhibits of the things they have to sell. Manufacturers of heavy, durable goods are faced with a greater problem. Much of their merchandise is built to customers' specifications and can't be stocked like hardware on a shelf. Also, unlike Fuller brush men, their salesmen can't carry the equipment around to show to prospective buyers.

Despite these limitations, General Electric Company found a way to present to American industry a cross section of the things it makes. A few weeks ago its Apparatus Department launched a nation-wide tour of a special train which displays more than 2000 G-E products designed to produce, distribute, and utilize electric power. As it took to the rails, it represented more than two years of planning and construction and an expenditure upwards of $500,000. Clayton P. Fisher, Jr., formerly of the Apparatus Department News Bureau, was in direct charge of the preparations. The train has been named "More Power to America Special," and is the latest medium devised by the company to implement a sales-promotion program that was inaugurated in 1944.

Company officials state frankly that they are sending the special around the country to stimulate sales. During this year and next, the 10-car electrical display kit will visit some 150 key cities. It will not be open to the general public; instead, visits will be confined to invited representatives of electrical utilities, manufacturing establishments, transportation systems, the armed services, and federal- and municipal-government men. The train's mission is to interest those persons who either produce power or put it to work.

When press representatives were afforded a preview of the train in New York City on April 24, General Electric spokesmen headed by Robert S. Peare, vice-president in charge of public relations, explained the reasons that motivated the unique tour. Henry V. Erben, vice-president and general manager of the Apparatus Department, pointed out that the United States has doubled its consumption of electricity every eleven years since the turn of the century and stressed the importance of this form of power in driving machinery that has enabled industry to improve and expand its production. "This modern equipment, together with the continued decrease in the cost of electricity has," he said, "helped keep down prices in relation to other items such as increased labor costs. It has also meant higher quality and an ever-rising standard of living."

However, Mr. Erben noted that the production of durable equipment for modernizing and expanding industry dropped from 20.7 billion dollars in 1948 to 19.7 billion in 1949, and that a further decrease of 14 percent is forecast for 1950. Consequently, he declared, "It is high time all of us in American industry started to reverse the trend." He reported that General Electric Company has invested nearly half a billion dollars since the war ended in new plants and in rearranging and modernizing existing facilities. "We are spending our dollars as evidence of our faith in the future," he stated, "and through this train we hope to encourage others to do the same."

In similar vein, C. H. Lang, vice-president in charge of Apparatus Department sales, characterized the train as a means of "bringing every industrial and civic leader in America face to face with his electrical opportunities." The special, he said, symbolizes the modern concept of industrial selling in which the salesman is not so much a peddler as a buyers' counsel. "If he is in business for keeps — and General Electric is — he will see to it that every sale results in a fair profit for both the buyer and the seller. It is on this basis of friendly business adviser that we have launched this electrical fair on wheels. This is a deliberately commercial venture—a bold and original investment in sales promotion. And instead of hiding the fact, let us all recognize the vital role of creative salesmanship and sales promotion in our vigorous American economy."

Citing the fact that G-E engineers have accounted for 8000 inventions,

roughly two a day, for the past ten years, J. S. Smith, manager of advertising and sales promotion, commented that these ideas would remain impotent unless put to work and properly publicized. Many of them are embodied in the capsule-form exhibition. It takes about two hours to have a good look at everything in the ten cars. Some pieces of equipment such as generators, transformers, etc., that are too bulky and heavy to put into the 9½-foot-wide space are represented by scale models or other means. Oftentimes, however, the reproductions give the viewer a far clearer understanding of the apparatus than do the actual pieces.

The exhibits are arranged according to a definite plan, with machinery for producing electric power in the forward cars. Next come equipment and techniques for its transmission and distribution, and then numerous products and methods for putting power to profitable use. The displays are divided into the following sections: power generation, transmission, and distribution, drives and controls, materials handling, welding, industrial heating, renewal parts and service shops, industrial lighting, components for industry, measurements, national security, and civic improvement.

Most of the major exhibits that are operable go through their cycles automatically or can be energized by visitors. Explanatory signs, talks emanating from hidden mechanisms, motion pictures, and other visible and audible aids to understanding are provided. In each car are two G-E student-engineers schooled to answer questions concerning the displays. These boys will ride the train for 90 days and then be replaced for a like period by similarly trained personnel. All told, the train carries a staff of 30, and at each stop local company representatives will also lend a hand.

The striking increase in the utilization of electricity that has accompanied the nation's industrial growth is brought out by printed messages in the cars. It is pointed out, for instance, that in 1900 American workmen used only 0.1 kw-hr. of current per man-hour and that production of goods and services totaled 50 billion dollars. Today, power consumption per man-hour averages 6.2 kw-hrs. and goods and services aggregate 265 billion dollars annually. Equally significant figures reveal the mounting application of electricity in the home. In 1900, only 500,000 houses were wired and used an average of 200 kw-hrs. per year, whereas 37,300,000 houses now consume an average of 1660 kw-hrs. in the course of twelve months.

The train itself is a part of the exhibit. It is drawn by a 2-unit, 4500-hp., diesel-electric locomotive built by American Locomotive Company and General Electric Company and geared for operation at a maximum speed of 92 miles per hour. The stainless-steel cars are of regulation passenger-carrying design constructed by Pullman Standard Car Manufacturing Company. At the conclusion of the tour the train will be taken over by the Chicago, Rock Island & Pacific Railroad and equipped for passenger service.

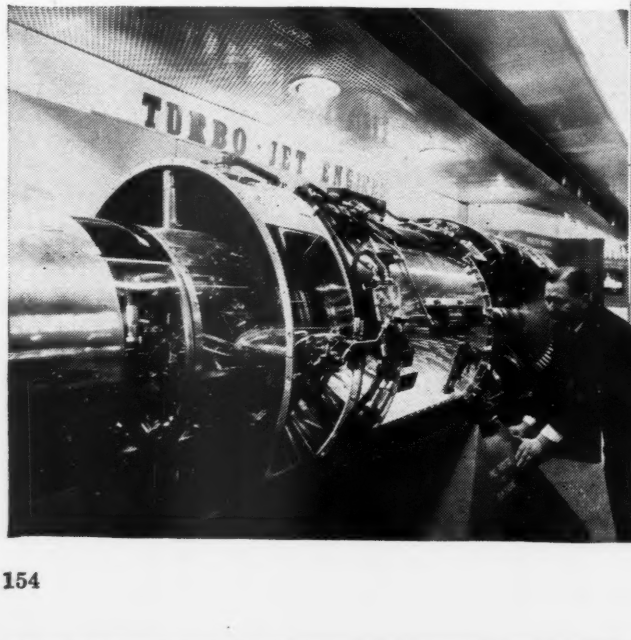
Underneath each car is a diesel-engine power plant of 30-kw. capacity mounted so that it can be swung out into the open for servicing. These units supply electricity for heating, lighting, and air conditioning the train and for operating the exhibits on board. Each engine-generator set weighs less than a conventional axle-driven generator with its accessory equipment. Heat from the engine exhaust and the cooling water is used to supplement the electric heating elements in the cars.

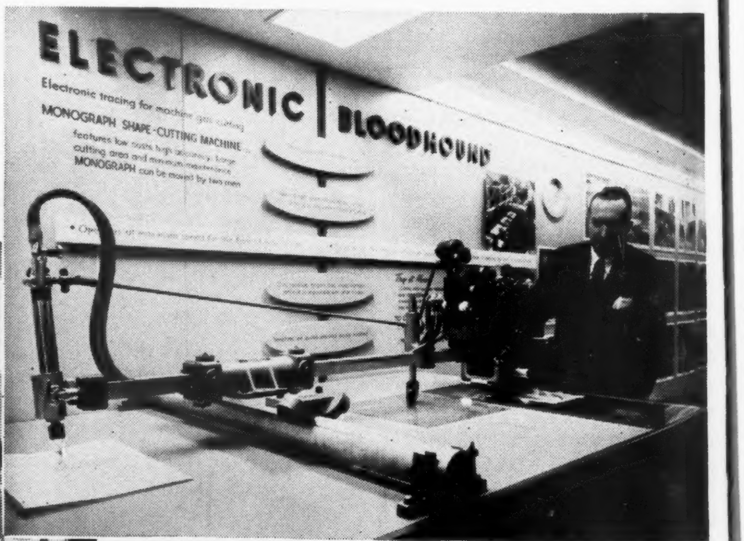
Compressed air enters into the operation of the train and some of the exhibits. On the locomotive are separate air compressors for starting the two 2250-hp., turbosupercharged diesel engines. Other units furnish air for braking and for applying sand to the rails. All doors open at the touch of a hand and close automatically through the action of electropneumatic equipment provided by National Pneumatic Company. An exhibit depicting the operation of a nuclear power plant utilizes a stream of compressed air to give turbulence to myriads of tiny balls in simulation of atom-splitting.

The train was dedicated on April 25 by turning on the lights with the aid of atomic energy produced in the G-E Research Laboratory at Schenectady, N.Y. A silver dollar was radiated there, then placed in a lead-lined box and transported to New York, where the train was standing in Grand Central Station. Charles E. Wilson, General Electric president, removed the coin from its receptacle with long-handled tongs and placed it in the lead-lined chamber of a Geiger counter, an instrument used to measure radioactivity. When the clicks of the exploding atoms reached a designated count per second a relay was tripped to operate a master switch, and the train's lights flashed on.

TURBOJET ENGINE

Full-size cutaway model of the J-47 turbojet engine, below, that powers the North American Air Force fighter plane which set a speed record of 670 miles in 1948 as well as several other aircraft. About 3 tons of air per minute flows through the radial-type compressor in the unit's midsection. Two-thirds of the volume drives the rear-mounted turbine that operates the compressor, and the remainder is utilized as jet thrust.





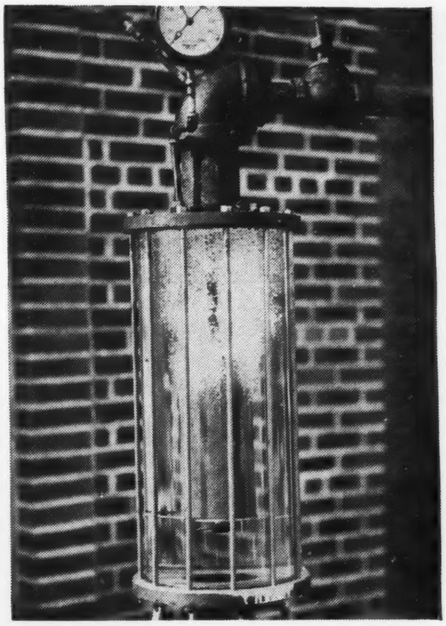
ACCURATE FLAME-CUTTING

K. R. Van Tassel, manager of the General Electric Control Divisions, is pictured above operating a machine that simulates precise automatic flame-cutting of metals, with a ball-point pen (left) substituted for the flame cutter. The detection unit at the right automatically follows a pattern located beneath it and reproduces it accurately at the left through electronic-signal processes. Irregular shapes can be cut with extremely close tolerances.

RUSTLESS WATER

Removal of Iron by Pressure Aeration Improves Taste, Ends Staining, and Curbs Corrosion and Clogging of Equipment

Frank E. Ferguson



ADMITTING AIR

G. A. Selby, waterworks superintendent at Nevada, Iowa, is shown above opening the air inlet of the plant Atomerator. The device aerates up to 280 gpm. of water and oxidizes 2.5 parts of iron per million. Since it was put in service in 1936 the top sand in the plant filtration filters has been changed a few times and the carborundum air diffuser in the Atomerator has been cleaned twice with hydrochloric acid. Meanwhile, housewives' white wash comes out cleaner than before, clothes wear longer, and coffee tastes better. Water meters that formerly corroded or clogged in six months now operate without attention for from three to five years. Flushing rust from mains used to consume an appreciable part of the water supply. Now about one percent of it is required to remove captured iron from the filters by reverse flushing. At the right is pictured a glass-enclosed Atomerator that shows finely divided bubbles of air being introduced into flowing water through a central cylinder of porous carborundum.

THANKS to compressed air, many small communities of 100 to 8000 people are now being supplied with water free from undesirable iron. Iron found in well water is usually in a soluble state, commonly in the form of ferrous bicarbonate. When first drawn from deep wells the water is clean and colorless, but it becomes cloudy upon exposure to the air and finally deposits a yellowish or reddish-brown sediment. For home use such water is objectionable because the iron stains glassware, porcelain fixtures, clothes laundered in it—in short, just about everything with which it comes in contact. It unites with tannin in tea and coffee and affects both flavor and appearance. It also gives an unpleasant taste to drinking water.

In industry, iron is equally undesirable. For example, in tanneries it spots and stains leather; in pulp and paper mills it results in stains, with attendant losses during bleaching; and in rayon plants, textile mills, and dye houses it is well-nigh impossible to operate with water containing iron. Pipe lines carrying such water are often clogged with deposits of iron bacteria known as crenothrix—a growth peculiar to spring and well water. However, by means of a device patented by the General Filter Company of Ames, Iowa, iron can be removed from water before it reaches the consumer. It is called the Galligan-Roach Atomerator and is based upon the principle generally known as pressure aeration.

Most of us are familiar with the fountain-type aerator commonly seen in city water works in which small droplets of water pass through the air. But in the Atomerator, air under pressure is passed through the water in a closed system. The latter minimizes contamination, and as most well water used by small municipalities is free from harmful bacteria it is usually unnecessary to resort to chlorination. But to make sure that the entire system is sanitary before the Atomerator is put into operation, chlorine gas is introduced into the water-filled units. After the chlorine has had enough time properly to sterilize the system, the water is drained off. Normally, no further bacteriological treatment is needed.

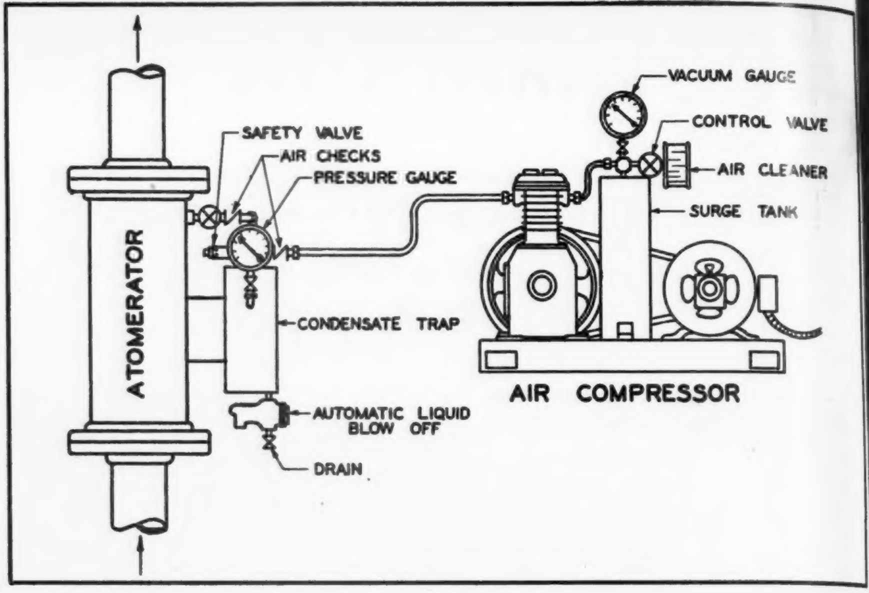
In service, the system works as follows: water is pumped from the well directly into the Atomerator where aeration takes place and the soluble iron salts, if any, are oxidized. From there the water travels to the top of a pressure filter where sand and gravel remove from it the rust particles which have formed in its passage through the Atomerator. From the filter the water may flow to other treatment equipment, to reservoirs, or into distribution mains.

The vital part of the system is a flanged section of pipe, 2 feet in diameter, which is larger than the water main. Inside this section is a diffuser, a carborundum tube about 4 inches in diameter and 12 inches long. Air under constant pressure is pumped into the tube which, being porous, allows the air to escape as minute bubbles and mix freely with the water. Well-nigh instantly the contained oxygen combines with the iron in solution to form particles of insoluble rust that are carried into the sand filter, where they are separated from the water.

Air pressure varies from 20 to 100 psi., depending upon the installation, and must be carefully controlled. If the air is admitted at too rapid a rate the water becomes cloudy. The same thing sometimes happens with the hot-water supply in homes and buildings. It is caused by

air under pressure being absorbed by the water. Then, when the water is tapped, the pressure drops to atmospheric and the air, in the form of tiny bubbles, gives the water a milky look. So annoying is this so-called "white water" that, before the introduction of the Atomerator, some states passed laws forbidding the use of compressed-air systems for purifying water.

Water can be aerated under pressure without causing white water only by the careful regulation of the air supply. This is done in the case of the Atomerator by a control valve, a surge tank, and a vacuum gauge, all mounted on the intake side of the compressor. The valve setting determines how much air the machine will draw in, compress, and deliver to the aerator. The surge tank acts as a cushion for the air after it has passed through the valve and smooths out the pulsations caused by the compressor piston. The vacuum gauge measures the compressor intake vacuum, which varies from 5 to 20 inches, depending upon the installation, and indicates the volume of the air flow. This control arrangement avoids the excessive use of air that is the cause of white water.



PRESSURE-AERATION ASSEMBLY

To avoid excessive introduction of air, which causes water drawn from taps to appear milky, the intake side of the compressor is equipped with a vacuum tank, vacuum gauge, and needle-valve control. The valve is adjusted to admit just enough air to oxidize the iron present. The reading on the vacuum gauge is recorded, and this same vacuum is maintained whenever water is pumped.

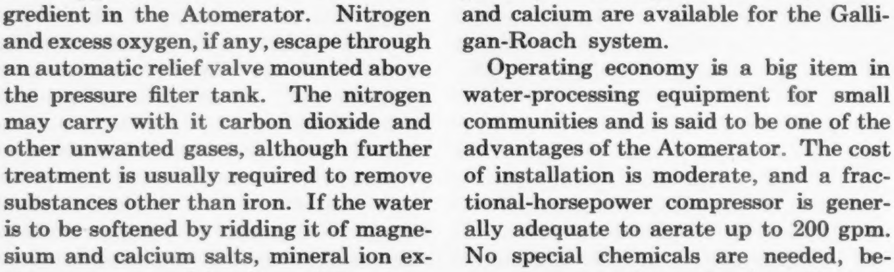
Air is made up of about 78 percent nitrogen, by volume, and around 21 percent oxygen, which latter is the active ingredient in the Atomerator. Nitrogen and excess oxygen, if any, escape through an automatic relief valve mounted above the pressure filter tank. The nitrogen may carry with it carbon dioxide and other unwanted gases, although further treatment is usually required to remove substances other than iron. If the water is to be softened by ridding it of magnesium and calcium salts, mineral ion exchangers are used in place of the atomerator section; and new high-capacity resins which remove iron as well as the primary hardening minerals magnesium and calcium are available for the Galligan-Roach system.

Operating economy is a big item in water-processing equipment for small communities and is said to be one of the advantages of the Atomerator. The cost of installation is moderate, and a fractional-horsepower compressor is generally adequate to aerate up to 200 gpm. No special chemicals are needed, because oxygen, the active ingredient, is obtained directly from the compressed air. The system can be made completely automatic if desired.

Any water which contains more than 0.5 parts of iron per million will stain laundry, porcelain fixtures, etc. For general household use a tolerance of 0.3 ppm. of iron has been fixed by many state boards of health, and the U.S. Public Health Service *Drinking Water Standards* specify that iron and manganese together shall not exceed 0.3 ppm. For industrial uses the permissible limit is much lower. In the manufacture of high-grade pulp and paper products, for instance, the Technical Association of the Pulp and Paper Industry recommends a tolerance for iron of 0.1 ppm. The iron content of well water varies considerably. In the majority of cases it ranges below 5 ppm., in a few from 5 to 15 ppm., and an occasional well may yield 40 ppm. or more. Even a small atomerator installation is therefore adequate for most needs because it is designed to separate out as much as 25 parts of iron per million parts of water.

Oddly enough, people have asked the manufacturer if removing iron and other minerals from water is not bad from a health standpoint. In reply, General Filter Company points out that one would have to drink all the well water in a good-sized bathtub if one wanted to obtain the usable minerals contained in a well-balanced meal.

Many towns and cities in the Midwest are tipping their hats to the Atomerator for a twofold purpose: as a farewell to the 1001 inconveniences of iron-bearing water and as a salute to compressed air through which the difficulty has been overcome.



INSTALLATION AT ALMA, WIS.

This Atomerator removes the iron from 250-300 gpm. of water in a town with a population of 1200. In the background are filtration tanks, and overhead is the small motor-driven compressor that supplies the air.

Are You Just Crazy About Art . . . or Is Art Just Crazy?

*John M. Sitton**

METROPOLITAN MUSEUM OF ART

2400 YEARS APART

The drinking cup shown above was used by Athenians around 400 B.C. Compare its gaudiness and unwieldiness with the simple and graceful lines of the Coca-Cola bottle. The latter, originated by a famous industrial engineer, is mass-produced modern art. The bottle is easy to hold and easy to look at.

COLLECTION MUSEUM OF MODERN ART

IS IT ART?

This painting of a girl looking in a mirror, although admittedly unusual, is a serious effort by the great living artist Pablo Picasso to use design to tell a story. Maybe you wouldn't want to hang it in your home, but it is considered a masterpiece, and the Museum of Modern Art in New York City is proud to own it.

When you look about you for masterpieces of art, let your eyes rest on a sleek diesel giant of the rails, the functional beauty of a modern automobile, or on a suspension bridge. These marvels, and many more like them, may be today's most vital art expression

HAVE you found yourself wondering what modern art is all about—those zigzag lines and daubs of wanton color? Have you caught yourself saying, "Those queer people gawking at crazy-looking pictures in museums are not art lovers, they're art lubbers." At any rate, get hold of yourself, for art is here to stay whether you like it or not. No matter how much you dislike and criticize the nutty pictures you see in the magazines—the prize-winning strange-looking pictures that turn out to be hung upside down in some galleries—no matter how much you and Aunt Mabel and Cousin Mamie rant and rave, art is here to stay.

The trouble is you may not really be looking at the vital typical art forms of our times. In this exciting industrial age in which we live, you may be trying to see greatness in the trivial, in the derivative subart creations that are merely the minor arts of our day. Look around you, up in the sky—see the flight-brilliant lines of a Constellation gleaming in the sun. Look at the utter functional grace of a suspension bridge, like a steel necklace dedicated to man's service and convenience. Despite its utility it is of breath-taking beauty. These are some of the things that may stand out in history as the greatest creative products of this age of fast-paced motion. Look at the pantherlike low, long lines of a streamline train; it is apt to be among the art masterpieces of today.

Does that sound like heresy? It's not, it's just common sense. It does not mean that contemporary pictures—not all of them anyway—deserve the "raspberry." Artists today are groping and experimenting for a form of expression to match the phenomenal scientific and technical advancement in more prosaic fields such as mass transportation or sending moving images through the ether. The art world, subconsciously or not, is trying to keep pace with other contemporary branches of human endeavor. Whether or not artists are succeeding often depends upon you and me, and millions more like us, for it is up to us to applaud when something vital comes along. Believe you me, we can boo plenty when we feel that we are having the wool pulled over our eyes. That's the beauty of art, you can take it or leave it.

Let's look at the art forms that have become a part of our lives. Do you start with the comics? Maybe you are not so far wrong; but you are not a hundred percent right either. Then look at the movies. The moving picture is certainly an art form typical of our age. Some are dull, indeed, but others are cracking good. It's up to you Mr. and Mrs. Public to pick the good forms of creative expression. You are the final arbiters, the critics, for it's your dollars and patronage that make today's wonders possible whether in the realm of art or science or technology. History has proved that art cannot be separate and apart from the time in which it was created.

Take sculpture, for instance. If by statues you have in mind the Civil War monstrosities erected on so many of our village greens, then you are limiting the field. If we think of sculptured objects as third-dimensional plastic creations of form arrangement, let's include the modern automobile. Everybody likes our elegant new cars because practically all of them are beautiful to behold. Prototype designs of automobiles are first modeled in clay in full-scale mockups, and a vehicle can be embellished just as legitimately as a picture painting or the

*Fellow of the American Academy in Rome

bust of a hero carved out of marble.

Even before the days of the Caesars, simple modes of locomotion were adorned to combine beauty with utility. An Etruscan chariot that was in use centuries before Christ might look to us like an embossed wheelbarrow, but it's still considered a vital expression of a bygone era. So why are not our sleek smooth-running cars a form of art too? You can bet that the long-forgotten emperor who owned the fancy bronze chariot now to be seen in the Metropolitan Museum in New York City would have given half his kingdom for a practical gas buggy that anybody can own today.

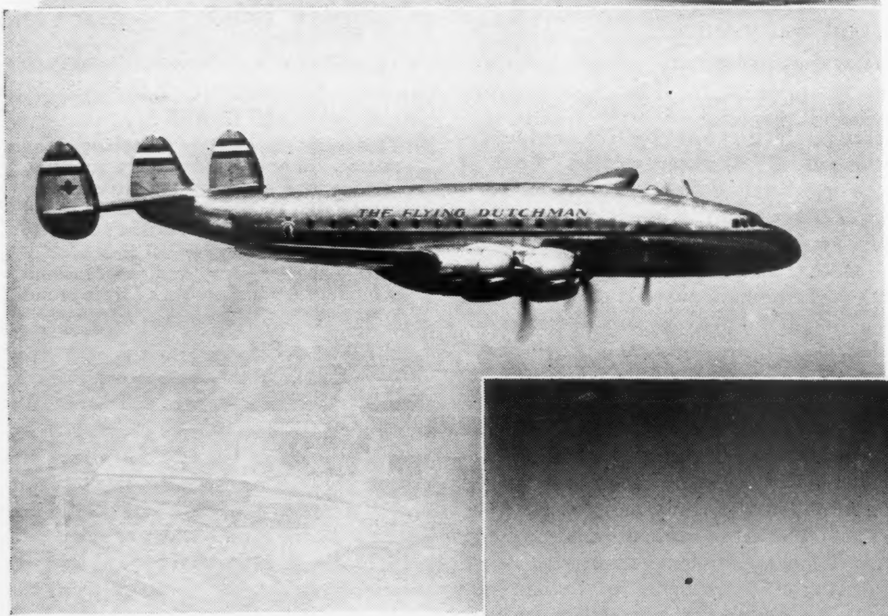
There is even great figure sculpture here and there, but the significant thing about our industrial modes of expression like automobiles and diesel engines and great airworthy planes is that they are marvels of ingenious organization quite beyond their limited aesthetic appeal if taken alone. Certainly some of our outstanding artists are to be found in the ranks of the so-called industrial designers. They are the practical fellows who are hired by manufacturers to make ordinary things more useful and at the same time more attractive and therefore more salable.

In this age of mass buying, the beauty of a utilitarian object is often a by-product, not the primary aim. It doesn't matter whether it's an automobile or a teapot, it must be not only economical to produce but convenient and practical to use as well; in short, it must be more functional. You may have heard of the "fur-lined" teacup. This is an example of the present "crazy" element of art that has been so highly publicized. Of course it's silly, to express it mildly, because it is utterly useless.

Do not be misled, though, into thinking that all art is silly nowadays, for it's not. We may be in one of the greatest creative epochs in the history of mankind — only man's eternal search for beauty of expression frequently resolves itself into the making of more useful tools in the objective sense wherewith to extend his power over his environment; that is, raise his standard of living. Mass-produced art forms can be even more beautiful than renowned masterpieces of past ages. Whatever you do, don't sell art down the river, but try to find art, or aesthetic experience, in your own everyday life. You might even help the artist create better art for better living.

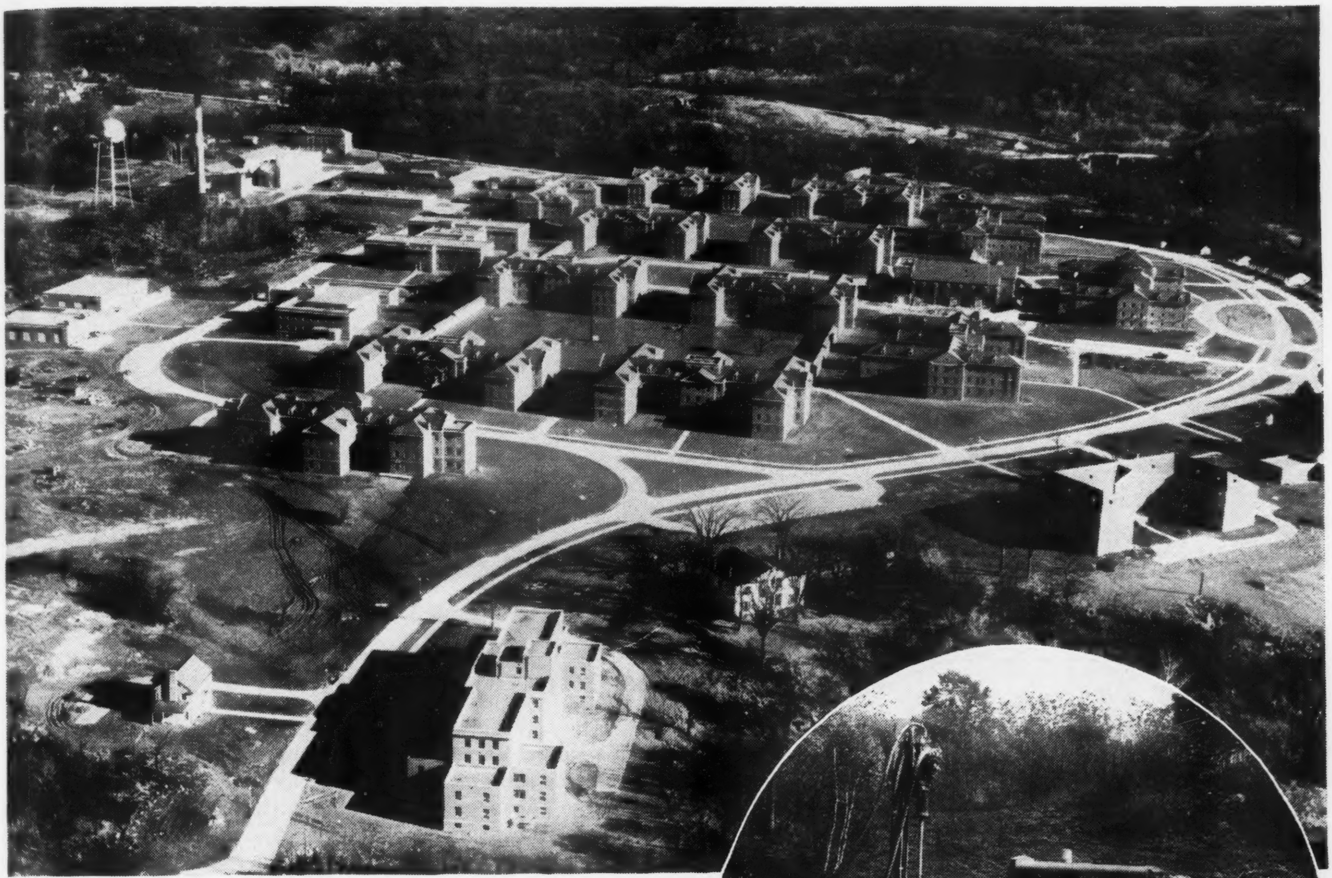
Art forms are traditionally an integral part of the period in which they are brought into being. It seems obvious that in our own time art has had less effect on functional industrial and technical design than the latter type of creative effort has had on styles of art. Now it's often fashionable for pictures or sculpture to look reminiscent of the "machine." Geometrical design or organization is frequently substituted for realism of representation. That is where we get the so-called nonrepresentational pictures; in other words, spots, dabs, squares, and circles. Perhaps the most original present-day creative expressions are to be seen in some of our planes, trains, bridges, machines, and appliances.

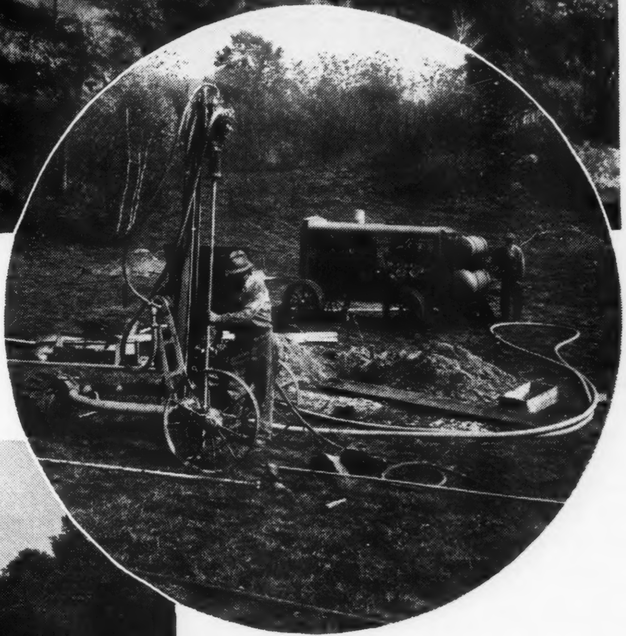
METROPOLITAN MUSEUM OF ART



VEHICLES FOR EMPERORS AND THE MASSES

The Etruscan bronze chariot which was in use centuries before Christ probably cost more than the most expensive modern automobile. Plainly, a great deal of care and artistic genius went into the making of this embellished regal vehicle. Contrast it, as a work of art and for utility, with the powerful streamline diesel-electric locomotive of today. Or compare it for beauty with the Constellation—a sleek sculptural form that was designed for functional simplicity rather than for useless ornamentation.





FIVE-YEAR TRANSFORMATION

THE picture at the top of the page shows the $22,500,000 Franklin Delano Roosevelt Veterans Administration Hospital near Peekskill, N.Y., which was formally dedicated on May 21. The two other pictures were taken on the site in 1945 when tests of subsurface conditions were being made for the information of the contractors intending to bid on the job.

Because of the peculiar geological conditions under which rock might outcrop at one point and be 15 or 20 feet underground only a few feet away, conventional exploratory equipment proved to be unsatisfactory, so wagon drills were adapted for the purpose. Throughout the 1200x1644-foot building area of the 383-acre tract were put down holes with a maximum spacing of 40 feet wherever a structure was to rise. All told, 703 holes with a total length of 3567 feet were drilled in only 25 days. The work was described in our August, 1945, issue.

The hospital has facilities for 1965 patients, in addition to offices, nurses quarters, heating plant, etc. As shown, it is complete except for grading and landscaping. Construction was directed by the War Department, Corps of Engineers, New York District. Thirty-two of the 37 buildings were erected by Merritt-Chapman & Scott Corporation of New York City.

SYSTEM UNDER TEST

Eighteen seconds after heat was applied to one of the heat detectors, foam began to discharge from the sprinkler heads, as shown at the right. After 3.3 minutes of operation the ground in the spur-track area was covered to a depth of about 7 inches (below).

Fighting Fire with Bubbles of Air

BLANKETS of foam have been used for many years for putting out fires involving flammable liquids. Consisting of chemically induced bubbles of carbon dioxide, the foam has been an excellent medium for smothering flames, but its usefulness has been limited because of the difficulty of designing a simple system for applying it.

Shortly before the outbreak of World War II, there was developed a more adaptable substance that formed a blanket of foam made up of a mass of mechanically induced air bubbles instead of the chemically created CO_2 bubbles. Handling and usage involved no difficulties, with the result that the military authorities took practically the entire output during hostilities. In the Navy it became popularly known as "bean soup."

One of the several materials used to induce foam mechanically is a hydrolized protein that is derived from soybeans and sold as Aer-O-Foam. When mixed 6 percent by volume with water and aerated, it forms a homogeneous, tenacious blanket capable of flowing around objects and quickly smothering burning gasoline, benzol, naphtha, and many similar liquids.

At the factory of the Schenectady Varnish Company, manufacturers of synthetic resins and insulating varnish, there was recently installed and tested an Aer-O-Foam fire-protection system. Tank cars carrying such flammables as naphtha and benzol arrive at the plant on a railroad spur, with storage tanks on one side and an unloading platform on the other. The problem was to control and isolate a spill fire that might occur anywhere in that area, which is practically inaccessible to the city's fire-department equipment.

Realizing that the unloading point was a fire hazard to its plant, the company requested the Factory Insurance Association to study the problem. Investigations indicated that an Aer-O-Foam system automatically controlled by approved sprinkler-system valves would serve the purpose, and the Automatic Sprinkler Corporation of America was commissioned to install one.

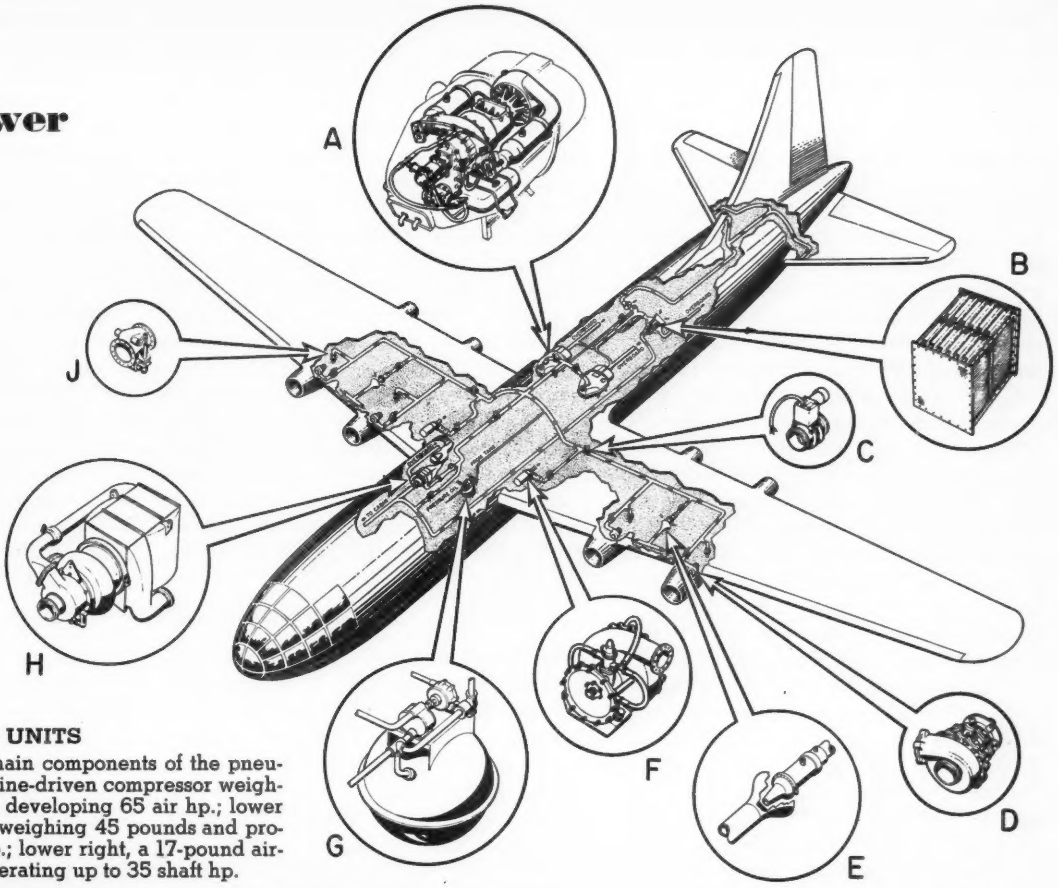
The protected section varies in width from 25 to 40 feet, is about 450 feet long, and is divided into three system areas, each regulated by one 6-inch Suprotex-Deluge valve operated pneumatically by pressure impulses from strategically located heat-actuated detectors. The foam-forming liquid is stored in a tank divided into two 400-gallon sections from which it is pumped into distribution pipes. The connection between one tank compartment and the pump suction is always open, while the other connection is kept closed so that the system may be immediately returned to service following a fire. The fluid is metered into the pipe lines through orifices controlled by small companion valves operated pneumatically by the Suprotex-Deluge valves. But before the pump is started by low pressure in the distribution system, a "supervisory" 50-gallon tank supplies Aer-O-Foam to portable outlets at nine points within the plant.

The liquid is piped to sixteen overhead aerating and discharge devices in each zone, as well as to the nine portable stations that serve hoses. Water is mixed with it at a metering point, and air to create the foam is drawn in at the discharge outlets by the suction that feeds the mixture to and sprays it from the nozzles. Dispersion of the mechanically formed air bubbles is promoted by directing the water against a deflector head. The pressure at the sprinklers is about 75 psi., which gives each area system a foam-discharge capacity of around 8800 gpm. The equipment includes alarm gongs and other devices required for approved sprinkler systems. Foam is delivered at a rate that will cover a flat surface to a depth of about 2 inches in one minute. This will extinguish a fire in less than three minutes, it is claimed. The storage capacity of each of the two tank sections is sufficient to provide 58,000 gallons of foam or to operate for more than 7½ minutes.

In testing the Schenectady installation, one of the three systems and the portable hose stations were given a complete tryout. Within eighteen seconds after heat had been applied to one of the heat-actuated detectors, liquid was flowing through the pipes, and two seconds later foam was being discharged.

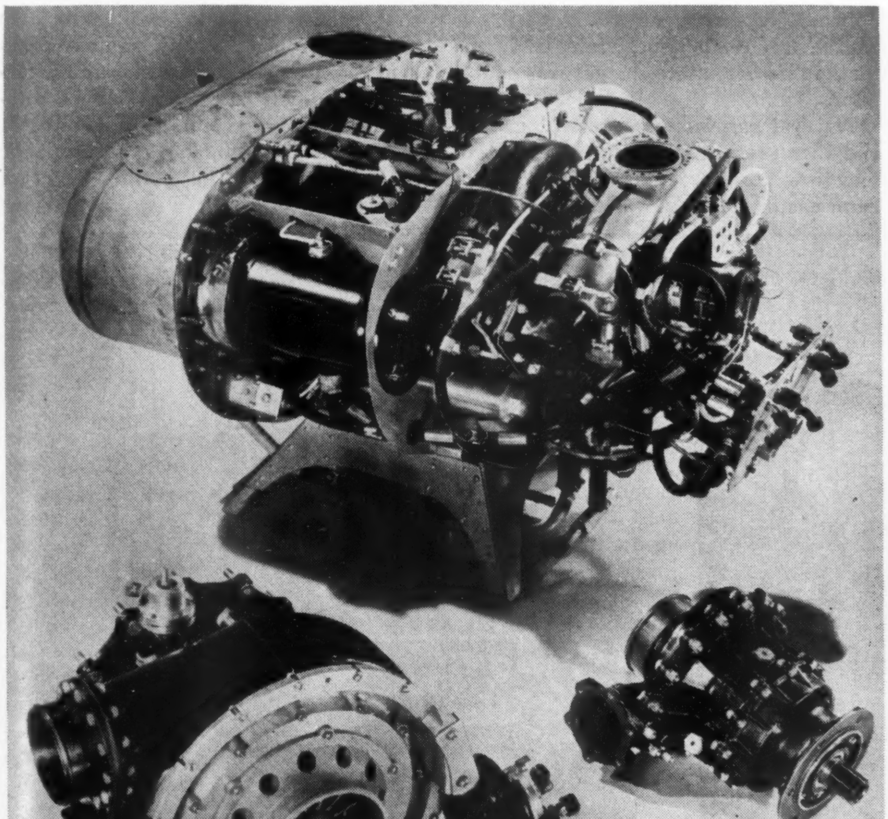
The system was allowed to function for 3.3 minutes, during which time 190 gallons of Aer-O-Foam was consumed. The ratio of liquid to water was between 6 and 6½ percent, and the foam covered the spur-track area to a depth of approximately 7 inches. Water was then thrown onto the blanket with no apparent dissipation of the foam. Within a few hours, however, it dried and disappeared.

Auxiliary Power for Turbine Propelled Aircraft



INSTALLATION DIAGRAM
How the system might look if installed on a jet-propelled plane to provide auxiliary power, independent of the main engines, for engine starting, wing de-icing, cabin heating and air conditioning, and oil pressurizing. The units shown are: A, gas-turbine compressor; B, cabin air heater; C, motorized shutoff valve; D, pneumatic starter; E, pneumatic de-icer; F, pneumatic alternator drive; G, hydropneumatic accumulator; H, cabin air-refrigeration unit; J, check and shutoff valve. The starters are coupled directly to the main engines, the alternator drives may be located near the accessories they power, and the gas-turbine compressors can be installed anywhere in the plane. Assemblies A, D, and F are shown in the illustration at the left.

MAJOR UNITS
Shown below are the three main components of the pneumatic system. Top, a gas turbine-driven compressor weighing less than 100 pounds and developing 65 air hp.; lower left, an air-turbine alternator weighing 45 pounds and producing from 25 to 70 shaft hp.; lower right, a 17-pound air-turbine starter capable of generating up to 35 shaft hp.



An airplane in flight can draw on the power of its engines to provide heat, light, radio communication, and other services. But on the ground, with engines shut off, it needs auxiliary power for these purposes, as well as for starting the engines when it is again ready to take off. Various means, including electric storage-battery systems, auxiliary internal-combustion engines, hydraulic systems, solid propellants, or combinations of them, have been devised to meet these requirements, but all have certain disadvantages such as too much weight or dependence on the main engines for some of their power. The problem, which is serious enough in designing conventional aircraft, has become even more acute with the advent of jet-propelled and turbine-driven ma-

chines which need much more powerful starting devices than do planes driven by reciprocating engines.

AiResearch Manufacturing Company of Los Angeles, Calif., thinks it has the answer in a lightweight, independently operated auxiliary power and starting system. Working under the sponsorship of the U.S. Navy Bureau of Aeronautics and Consolidated Vultee Aircraft Corporation, it has developed and built a pneumatic system which, it claims, will enable a turbine-propelled craft to extend its activity while remote from a major base. It permits the operation of accessories when the main turbines are idle, serves as a supplementary source of power for the same accessories when the plane is in flight, and can start the engines an unlimited number of times without drawing on power from any ground plant. It has been installed on the 60-ton Convair XP5Y-1 turboprop flying boat constructed by Vultee for navy patrol duty and now undergoing tests.

The system on the Convair consists of two small gas-turbine compressors, two air-turbine alternator drives, and four air-turbine starting units. The compressors, each of which weighs less than 10-pounds and develops 65 hp., use the same fuel as the main engines and deliver the air through ducting to the turbine alternators and starters. Striking the turbine blades, the air whirls them around at speeds exceeding 30,000 rpm. The alternators generate approximately 25 hp. each and operate the craft's accessory equipment through the medium of reduction gearing.

When the plane is ready to fly, the starters, each of which develops 35 hp., crank up the four 5500-hp. Allison turboprop engines to firing speed and then help to bring them up to idling speed. During flight, some of the air compressed by the main engines is bled from them and either sent to the turbine-driven alternators to actuate the accessory equipment or used directly for operating pneumatic controls or other devices. When using air from the engines, the alternators are capable of producing up to 70 hp. each. Normally, the auxiliary gas-turbine compressors are idle while the craft is aloft, but they may be run to supplement the main engines with their variable output or, when necessary, to provide accessories or controls with a continous supply of air at constant pressure.

AiResearch claims that its pneumatic system makes turbine-propelled aircraft independent of ground power units. In a harbor, lagoon, or other spot remote from its home base a plane so equipped could maintain radio contact with its base, develop its own utilities such as heat and light, and also carry on other essential activities for an extended period without once starting its main engines. Large groups of aircraft could be shifted suddenly to strategically located airfields devoid of power plants where fast starting would be of primary importance.

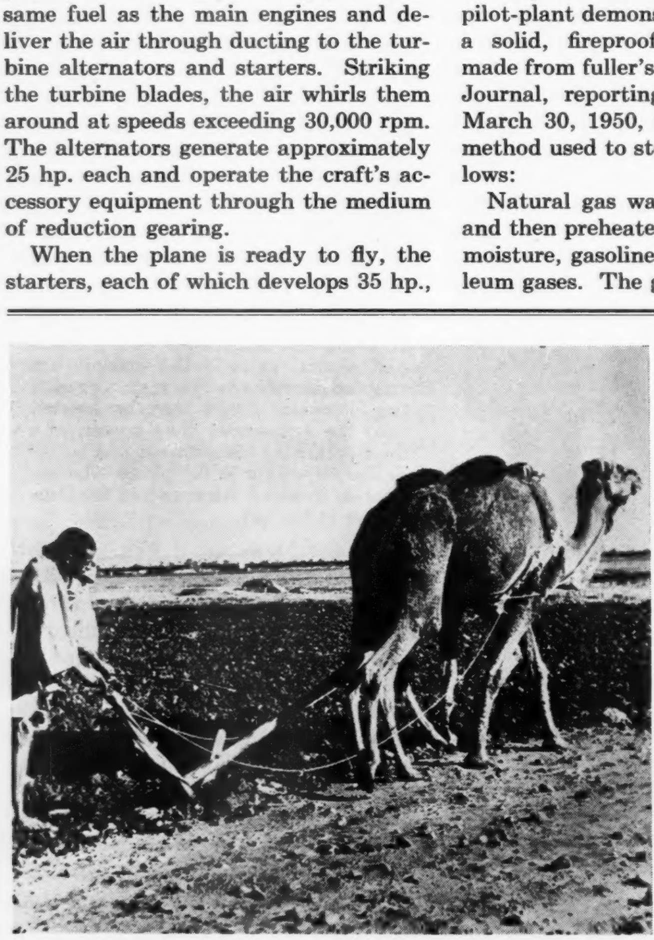
According to the manufacturer, the auxiliary pneumatic system is not only suitable for turbine-propelled aircraft for military use but can also be adapted for commercial planes. In addition to being a source of power independent of the main engines, it can perform such vital functions as wing de-icing and cabin pressurizing, as well as heating and air conditioning.

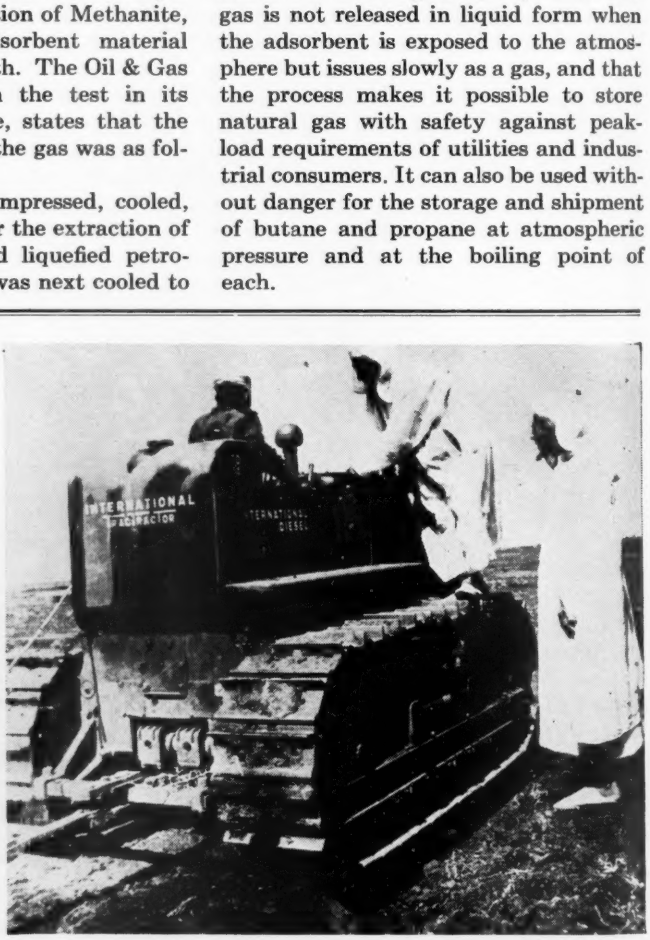
More Gas Storage in Less Space

CAN more than 600 cubic feet of natural gas be put into 2 cubic feet of granular adsorbent? The answer is yes, according to Floridin Company of Warren, Pa., and J. F. Pritchard & Company of Kansas City, Mo. The two firms recently proved that it could be done by a pilot-plant demonstration of Methanite, a solid, fireproof adsorbent material made from fuller's earth. The Oil & Gas Journal, reporting on the test in its March 30, 1950, issue, states that the method used to store the gas was as follows:

Natural gas was compressed, cooled, and then preheated for the extraction of moisture, gasoline, and liquefied petroleum gases. The gas was next cooled to remove ethane and to condense methane. The resultant liquid was flashed to a low pressure for further cooling, then introduced into the Methanite storage chamber at a temperature of minus 260°F.

C. V. Spangler of Pritchard Company, continues the magazine, says that the gas is not released in liquid form when the adsorbent is exposed to the atmosphere but issues slowly as a gas, and that the process makes it possible to store natural gas with safety against peak-load requirements of utilities and industrial consumers. It can also be used without danger for the storage and shipment of butane and propane at atmospheric pressure and at the boiling point of each.

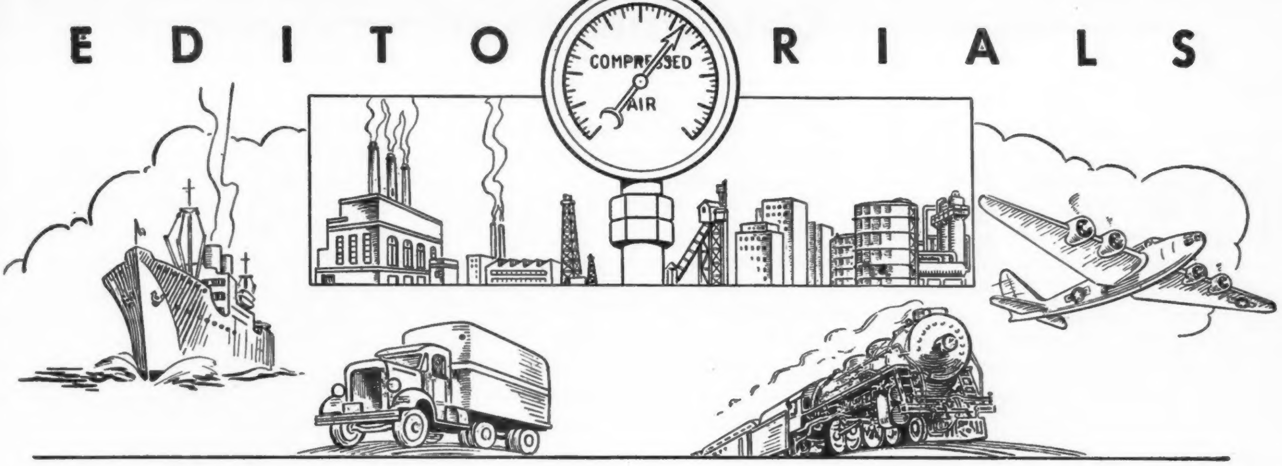




FARM MECHANIZATION IN MOROCCO

Up to February 1, more than $5,000,000 worth of American farm machinery has been shipped to the French North African protectorate of Morocco under the provisions of the Marshall Plan. The camel-drawn plow, which scratches 4-inch furrows, has been in use since the time of Mohammed and is now being replaced by tractors. Modern methods, introduced on 40 government-financed farms, have already increased the wheat yield from 4½ to 33 bushels per acre. The aim is to boost the food supply for the native population, which is increasing at the rate of 180,000 annually.

EDITORIALS



ENGINEERING EDUCATION

CONSIDERING the dominant part technology has played in developing our national economy, it seems almost unbelievable that collegiate engineering education in the United States is little more than a hundred years old. It is a fact, however, that few technical courses were available until well along in the second half of the last century and that the great expansion of our engineering schools came about within recent decades.

Attention is drawn to these truths by an announcement from Dean Ivan C. Crawford, College of Engineering, University of Michigan, that his school is planning to celebrate its centennial in 1952. Although instruction in engineering was started there less than a century ago, Michigan bears the distinction of having introduced it in American state universities. A course in civil engineering was listed in its 1852-53 catalogue, but it was not until two years later that facilities for it were provided. One faculty member, DeVolson Wood, was given the assignment, but along with it he taught several other subjects such as zoölogy and geology.

At that time, institutions of higher learning had been in existence in Europe for approximately a thousand years, but little heed had been given to technology. The University of Pavia was founded in Italy in 825 by Lothaire, a grandson of Charlemagne, and other places of higher learning came into being soon afterward. By the end of the twelfth century, there were three outstanding schools: Bologna for law, Salerno for medicine, and Paris for theology. From then on down through the ages numerous colleges and universities sprang up overseas, but the first one of record devoted primarily to technology was the "Mechanics Institute" founded in London by George Birkbeck in 1823. It was later called Birkbeck College and became a part of the University of London.

During America's early years, Great Britain frowned upon the development of manufacturing establishments in the Colonies and sought to keep them a dependency devoted to agriculture and to supplying raw materials to the Mother Country. Following the revolution, the infant nation was busy settling its frontiers, and it took time to develop the skills, fostered by enforced mechanical ingenuity, that eventually flowered into an amazing aptitude for industrialization.

Courses in technology in this country were first offered by the United States Military Academy at West Point in 1802, but they dealt mainly with military problems. The first purely technical school was opened in 1822 at Bowdoin College in Maine under Benjamin Hale, but it survived only ten years. In 1824, Stephen Van Rensselaer established the oldest of the nation's present engineering schools at Troy, N. Y. Its original purpose was teaching "the sons and daughters of farmers and mechanics." The first degree was not conferred until 1835. In 1847, Lawrence Scientific School was instituted at Harvard and Sheffield Scientific School at Yale. Next came the college at the University of Michigan which had been teaching other subjects since 1817.

The lack of fertilizers and, perhaps, too intensive cultivation led to depletion of the soil and soon brought us face to face with the fact that we had agricultural problems that needed attention. Partly in consequence thereof, Congress enacted legislation in 1862 granting land to the states for colleges of agriculture and mechanical arts. Concurrently, the trend towards industrialization was beginning to assert itself. Between 1820 and 1870 the proportion of the working population engaged in manufacture, trade, transportation, and professional services trebled.

In response to these influences, technical schools came into being at a faster rate. Whereas only four were available in 1860, there were seventeen by 1870 and 85 by 1880. More than half of the latter were land-grant institutions. The first technical colleges taught civil engineering only. Mining and mechanical courses were added in the 1860's, instruction in electrical engineering was introduced in the 1880's, and chemical engineering in the 1890's. Since then the tendency towards specialization has been on the increase and there are now more than twenty distinct branches of engineering in the curricula.

Up to 1866 only 300 men had been graduated by the six existing technical schools of established reputation. In comparison, scores of them now grant diplomas to more than that every year. During 1947-48, Purdue headed the list with 1452 degrees conferred, M.I.T. was second with 1410, and Michigan third with 1171. With four years yet to go before it rounds out its first century of actual engineering instruction, Michigan has already graduated approximately 15,000 students.

During the postwar period, enrollment in technical schools skyrocketed and the institutions were hard pressed to accommodate all who applied. Student bodies are now shrinking, and educators predict that they will continue to do so for several years. Temporarily, at least, graduates are having difficulty in finding employment in the lines for which they have been trained. This has led a number of industrial leaders to express the opinion that there should be some revision in technical instruction.

For example, William L. Batt, president of SKF Industries, Inc., says that too many men are being turned out with academic training and too few with vocational training. Surveys indicate, he asserts, that in business and industry there is currently a need for from three to five persons with practical training for every holder of a college degree. Citing aviation as an example, he thinks that relatively few very highly trained physicists and engineers will be needed in the next few years to deal with the complex problems of high speed and jet performance. On the other hand, he declares that there will be a big demand for men who understand how to operate machines, to weld and braze, to wire, to inspect, and particularly to test.

This and That

Steep Rock Grows

When Canada's Steep Rock iron mine was brought into production a few years ago by dewatering a large part of a lake that covered the deposits, it was believed that there were three ore bodies, and these were designated as "A," "B," and "C." As mining has proceeded, evidence that the three deposits may be connected is increasing. As originally defined, the distance between "A" and "B" ore bodies on the surface was 6000 feet. However, six diamond-drill holes put down in the intervening stretch have penetrated ore of good grade. Prospecting also has indicated the possibility of continuous ore between "B" and "C." Although confirmation of this theory will necessitate much additional probing, the revelations have led to predictions that Steep Rock may yield as much as 500 million tons down to a depth of 1000 feet. This is a greater tonnage than that proved so far in the newly discovered Labrador area. If the indications are borne out, it is expected that Steep Rock's annual ore output will reach a figure between six and ten million tons.

* * *

Drilling Teeth with Abrasive

The S. S. White Dental Manufacturing Company, of Philadelphia, Pa., has taken over the development and manufacture of the Airdent tooth-drilling apparatus invented by Dr. Robert B. Black, a dentist of Corpus Christi, Tex. Although the company is not yet ready to give out detailed information, its annual report to stockholders states that "Except for some further refinements . . . the experimental work appears to be finished and it is expected that equipment . . . will be available commencing early in 1951."

Doctor Black conceived his "airbrasive" technique in 1942 and since then has been improving it. Based on the principle of the sand blast, it excavates tooth cavities with aluminum-oxide powder carried at high speed in a stream of carbon-dioxide gas at 60 to 70 psi. pressure. According to a recent description, the mixture is delivered through a neoprene tube to a handpiece that resembles a fountain pen in size and shape and terminates in a small tungsten-carbide nozzle.

The tiny stream of abrasives, controlled by the dentist's foot, cuts away quickly and without the pressure, heat, and vibration associated with conventional rotary drills. A rubber shield or guard is placed around the tooth, and a suction device withdraws the spent powder from the mouth, thus preventing it from reaching the lungs. The patient suffers no pain and is conscious of only a tickling sensation.

The Airdent cannot be used on teeth in the back of the mouth or for making angular recesses, as it drills only round holes. In order that dentists may become familiar with the new tool and its application, faculty members of several dental schools are now being trained to use it so that they, in turn, can instruct their students.

* * *

Carbon Black Farming

Because black materials absorb heat, the addition of carbon black to top soil will extend the growing season of crops, according to experiments conducted at the Massachusetts State Experiment Station. In the tests, carbon black was mixed with the uppermost 2 inches of ground in the amount of 2 tons per acre. Temperature readings taken every fifteen minutes of the day and night for a year showed that in spring and summer the average maximum surface temperature was about two degrees warmer than that of adjacent untreated areas. At a depth of 2 inches, the difference was 3.4 degrees. Minimum temperatures were also slightly higher for the treated than for the untreated soil. This would seem to indicate that the inclusion of carbon black will enable farmers to plant earlier than they now do and leave the crops in the ground later in the fall. At the current price of carbon black (3½ to 7 cents a pound), the practice would be expensive, although it is believed that one application would suffice for several years. The tests also revealed that the amount of carbon black used per acre can be cut in half and still prove effective.

* * *

Cash from Rust

Although steel mills don't like rust because it is so fine that it blows out of blast furnaces, they buy a certain amount of it through necessity. Junk dealers who sell them iron and steel scrap include a little now and then and get by with the practice so long as they don't overdo it. Most commercial rust comes from railroads, which accumulate it when cars and locomotives are scraped prior to repainting. The deposits lie on the ground until a buyer places an order; then they are screened and shipped. One big road markets anywhere from 1000 to 2000 tons of the powdery stuff a year and receives from $3 to $16 a ton for it. Junk dealers' interest in rust is explained by the fact that they can get it for about one-quarter of the price they pay for scrap. Although most rust that is recovered ends up in blast furnaces, small amounts are added to quick-hardening cement. Strange to say, it is also an ingredient in a rustproofing compound. Iron filings, which include a considerable percentage of rust, are used for purifying manufactured gas.

* * *

Whaling from Aloft

The head of a large Portuguese whale-fishing concern, Marcelino dos Reis, plans to introduce a new method in the old industry. He proposes to drop a harpoon bomb on the huge creature from a helicopter hovering about 50 feet above the water surface. The barb carries a detonating charge which would explode and kill the mammal. Simultaneously, compressed air would be released to inflate the carcass and keep it afloat. Meanwhile, the pilot would call the nearby factory ship, which would dispatch a fast launch to tow in the catch. Then the helicopter, carrying a mechanic and a harpooner in addition to the pilot, would go in search of more whales. Senhor Reis claims that his innovation, if successful, will greatly reduce the expense of whaling by doing away with the present trawlers and their 20-man crews. Tests of the aerial harpooning method were scheduled to be made last month off Cape Espichel, south of Lisbon, where whales come within a few miles of the coast.

Moles Choose Officers

IDENTIFIED with heavy construction since 1912 and now New York manager for The Arundel Corporation, James F. Salmon has been elected president of The Moles, organization of tunneling and heavy construction men. Ralph W. Atwater, general manager of Shultz Dredging Corporation, Hoboken, N. J., has been made life honorary president. Other new officers are: Richard V. Hyland, of the firm of Madigan-Hyland, first vice-president; David Bonner, an officer of Frederick Snare Corporation, second vice-president; Albert E. Downes, of Lehigh Portland Cement Company, sergeant-at-arms; Howard P. Maxton, of Raymond Concrete Pile Company, treasurer. The newly elected trustees are: Jules R. Breuchaud, of Underpinning & Foundation Company; Ralph DeSimone, of Merritt-Chapman & Scott Corporation; Thomas Walsh, Jr., of Walsh Construction Company; and Robert H. Dodds, associate editor of Engineering News-Record.

Industrial Notes

A line of eleven portable tools named Guillotine has been designed by Manco Manufacturing Company for a wide range of cutting jobs. The unit shown is the Model 20-D with an open C-frame anvil that will cut ¾-inch monel, stainless-steel, and reinforcing rods; 1-inch mild-steel rod; 1-inch soft chain, ¾-inch hard chain, as well as hex-shaped and square material. Other machines of heavier construction will cut wire rope up to 1¼ inches in diameter and insulated and armored cable with a maximum outside diameter of 3½ inches. The basic Guillotine is available with any of four Manco pump units: with either a separate or an integral hand pump for field service, a ½-hp., 110-volt alternating- or direct-current motor that can be rewired for 220 volts, and an air-hydraulic assembly that consumes 16 cubic feet

of air per minute at a line pressure of 100 psi. Most of the cutters are designed to use two types of blades that can be easily removed for resharpening. According to the manufacturer, the tools exert a maximum thrust of 22½ tons and are capable of making a clean cut through 1-inch steel rod in 10-15 seconds and 1¼-inch wire rope in 20 seconds.

Capsules to put life into cold auto engines and get them going were used during the war to warm up tractors on the Alcan Highway in Alaska. Found to be a good remedy, California Oil Company is planning to put its Chevron Starting Fluid on the market this year, together with an adapter by which it is administered to the engine. The capsule contains a mixture of ether and ethyl and is inserted into the adapter, which may be installed on the dashboard or a post under the steering wheel. A plunger is then pressed to release the fluid, after which the driver primes the liquid, forcing it through one or more atomizing nozzles into the intake manifold. There the resultant vapor mixes with the incoming air and passes into the engine cylinders. Having a much lower ignition temperature than the petroleum fuel, the vapor is exploded by the ignition spark, preheating the combustion chambers and preparing them for the intake of the regular fuel. It is claimed that the capsule starts a stiff engine in less than 10 seconds with the thermometer at minus 25°F.

Of especial interest to air-conditioning and cold-storage concerns is the statement attributed to the Institute for the Study of Metals at the University of Chicago that steel and iron pipe can be protected against the corrosive action of water or brine by the use of tungsten and molybdenum compounds. It is reported that only a few hundred parts of sodium tungstate, potassium tungstate, potassium molybdenate, and sodium molybdenate in a million pounds of the circulating fluid will suffice to stop rusting.

Nickel-clad copper wire that combines the electrical conductivity of copper with the heat- and corrosion-resisting properties of nickel is being manufactured by Sylvania Electric Products, Inc., in diameters ranging from 0.010 to 0.115 inch. Though developed primarily for incandescent lamps of high wattage and electron tubes it has many applications in the form of stranded conductors as electrical leads for aircraft, electric furnaces, laboratory equipment, and home appliances. The wire is named Kulgrid.

Hydrauger Corporation, Ltd., has developed a new earth-boring tool for service-pipe installation. Known as the Scooter Model, it is 8 inches wide and weighs 150 pounds. It uses 1$\frac{3}{16}$-inch hollow boring bars in sections up to 10 feet long and bits of different types to drill 2- or 2½-inch holes in rock, hardpan, or clay. The machine features a full-length sled mount and an air-driven

cable winch that pulls the equipment along as the bit advances. Up to 70 feet of drill stem can be laid ahead of the Scooter and is moved into position, section by section, by the winch as boring proceeds. The latter also serves to withdraw the drill-bar assembly from the hole, and while this is in progress the service pipe can be drawn in. Like other Hydraugers, the operation of the new model requires the use of both compressed air and water, but it is the first of the type to have a built-in pump to circulate water under a pressure of 110 psi. to remove cuttings. The machine can work easily in cramped positions, as illustrated, and is used principally in boring through embankments and installing house service leads. Two sizes powered by a 3.2- or a 5.1-hp. air motor, respectively, are available.

For use where ordinary labels are impracticable or where continual handling would smudge or obliterate lettering, Labelon Tape Company has introduced a label in strip form made of two sheets of acetate with a special carbon material sandwiched in between. According to the manufacturer, it is water- and oil-proof, resistant to acids and tempera-

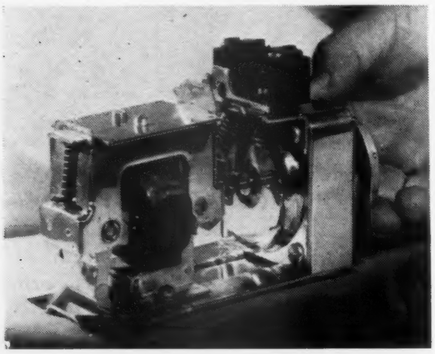
PHOTO, "AUTOMOBILE FACTS"

HUGE TIRES FOR HEAVY HAULING JOB

When the Arabian-American Oil Company finishes drilling an oil well in Arabia, it loads the complete derrick assembly on this giant dolly and transports it to a new location. Each of the carriage's pneumatic tires is 36 inches wide and 9½ feet high, weighs 3646 pounds, and can support a load of more than 27 tons.

tures up to 150°F., and markings by pencil remain permanent. Called Labelon, it is available in two widths—⅝ and ¾ inch—with blue or black edging. Labeling is packaged in a dispenser that permits tearing off any length desired.

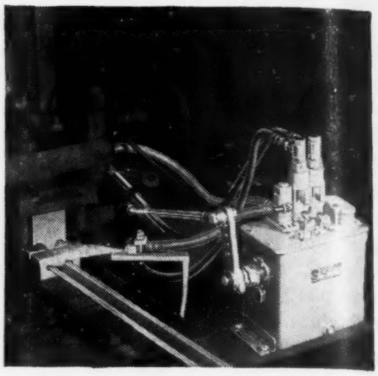
For general industrial timing functions, Westinghouse Electric Corporation has brought out a new type of pneumatic time-delay relay that can be adjusted by means of a large graduated dial to cover a range of delays from 0.2 to 200 seconds. Micromovement snap switches, with double "make" and "break"



contacts rated at 15 amperes, 115 volts continuous duty, are standard equipment. Additional switches for interlocking purposes can be furnished. Operating coils are available in ratings up to 600 volts alternating current, 25 to 60 cycles, and are designed to give satisfactory service down to 85 percent of the rated voltage. The relay, designated as Type AM, is made both in an open and an enclosed form, the latter having conduit knockouts top and bottom.

By means of a process recently developed by Electrofilm Corporation, a stable graphite film can be applied to well-nigh any surface by spraying or dipping. Though only 0.00015 to 0.0005 inch thick, the coating is said to be highly resistant to abrasion and to have excellent bearing strength.

Oil-mist spraying is a recently developed form of lubrication that is said to effect considerable savings in oil consumption and lengthen the service life of dies, punches, shear knives, and other wearing parts. Manzel, Inc., has taken its well-known Model 82 metering lubricator and converted it into a spray system of this type by the use of compressed air. Operated either by the movement of a machine's ram or crankshaft through a rod connection, the lubricator automatically applies variable quantities of oil at timed intervals. Low-pressure air, which can be taken from a shop line, delivers the lubricant to a nozzle aimed at the critical area and is controlled by a valve in the supply line. The volume of air used and the amount of oil sprayed are regulated by feed screws. For small-scale operations, a single- or double-feed



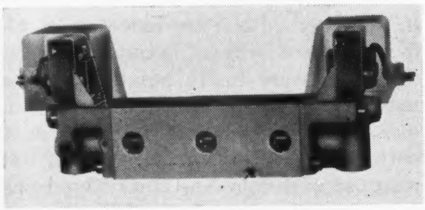
lubricator is adequate, but for larger coverage there are 6-unit lubricators each served by one manifold and one air-control valve. The lubricator has a liquid sight feed showing how much oil each pumping unit is supplying, and all working parts are inside the oil reservoir. Tightly sealed plungers prevent air from being drawn into the pumping units, anyone of which can be removed for examination or repair without stopping the lubricator. Aside from the advantages of mist spraying already mentioned, the air-and-oil stream has a cooling effect on die surfaces.

A miniature air cylinder is available for use with jigs and fixtures where size and space limitations are factors. Called Micro Model, it has a stroke of ⅝ inch and delivers a 75-pound thrust with air at 100 psi. line pressure. Applications in-

clude injecting or ejecting work, holding or clamping parts, and other processing or assembling operations. It is made by Air-Mite from solid-brass bar stock.

Compressed air that is ionized by passing it over radioactive isotopes of phosphorus is being used by Metallisation Ltd., of Dudley, England, in experimenting with a new metal-spraying technique. The metal is fed to the gun in the form of two wires and is melted by an arc produced by passing an electric current between them. The electrically conductive ionized air serves to atomize and blow the fluid metal on to the surface being coated.

Under the designation of Type DS, C. B. Hunt & Son, Inc., has introduced a new line of Quick-as-Wink solenoid valves for air and hydraulic service at pressures up to 200 psi. and 250 psi., respectively. Units feature small solenoids which, with a stroke of only $\frac{1}{8}$ inch, move a small pilot-valve plunger. The

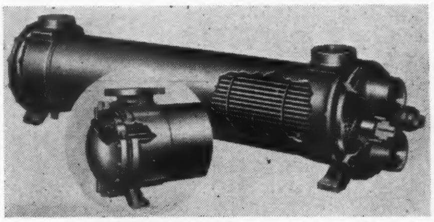


latter admits air to the operating cylinder which causes the main-valve plunger to travel back and forth. The low amperage requirements of the solenoid permit the use of standard-type pilot switches, thus avoiding intermediate relays; and because of the light weight and short stroke of the solenoid and the pilot-cylinder plunger the valves are especially suitable for high-cycle machines such as production welders. Two-, 3-, and 4-way types are available with solenoid control in both directions or automatic return and in sizes ranging from $\frac{3}{8}$ inch to 2 inches.

Griprite is the name of a new rubber glove with a roughened surface that is said to insure a firm hold even on tiny objects and under conditions of extreme wetness. The glove has curved fingers, is 14 inches long, and comes in sizes 9, 10, and 11. It is a product of The B. F. Goodrich Company and is especially recommended for workers around pickling and plating tanks, making batteries, in chemical plants, and in factories generally where acids and alkalies are handled.

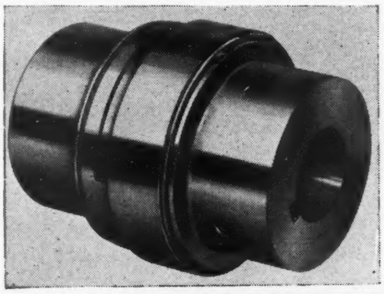
Resurfacing old or new concrete floors with Emerite, a product made by Flash-Stone Company, gives them sufficient strength, it is claimed, to stand up under heavy traffic and to resist the attack of acids, oils, molten metal, and similar destructive materials. A composition of crushed emery stone, a hardener, and a fast-curing cement, it is mixed with water and applied directly to the slabs, a layer $\frac{3}{4}$ inch thick being adequate for most purposes.

Originally built for use on Navy combat vessels, Ross Type BCP heat exchangers have been redesigned and are now available in a wide range of sizes for service on shore. These units are of stand-



ardized, all-cuprous construction to withstand corrosion, have a removable tube bundle for ease of inspection and maintenance, and are provided with a packed floating head with a positive safeguard against mixing of fluids. As contrasted with the company's earlier models, the new exchangers have larger transfer surfaces so that a smaller, less-expensive unit will do the work that formerly required a larger size. For example, a 12-inch shell that once housed 150 tubes of $\frac{5}{8}$-inch diameter now contains 172. Despite the more compact tube arrangement, it is claimed that pressure drop through the exchanger is held to a minimum because of the controlled flow conditions resulting from an improved close-tolerance baffle system. All sizes are equipped with integral brackets and suitable vents and drains for horizontal or vertical mounting.

Ease of installation and larger bore capacities are features claimed by Lovejoy Flexible Coupling Company for its improved L-R type "C" and "H" couplings designed for use on motor- or engine-driven pumps, compressors, generators, pulverizers, in fact nearly all machinery of 50 to 1000 hp. The inside sleeve is made in two parts, one for each body. Both of the latter are machined alike, making it easy to put the removable steel collar on either half of the



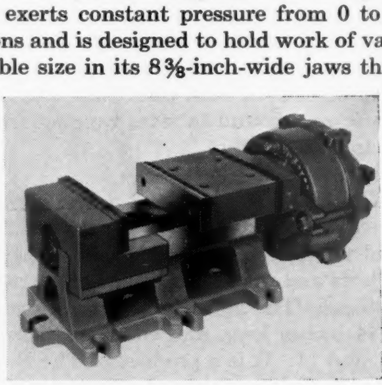
coupling. The collar is held in place by a snap ring. The new like the old models adjust themselves instantly for misalignment, shock, vibration, oscillation, surge, or backlash. Half of the cushions are idlers except on the reversing load, and

load cushions can be interchanged quickly without tearing down coupling. No lubrication is required. Units are available with several kinds of cushion materials such as Neoprene protected by bronze for service where oils, chemicals, etc., would normally cause deterioration.

To prevent overhead pipe from dripping in humid weather wrap it first with insulating Fiberglas 3 inches wide and then with a 2-inch covering tape, recommends Gro-Quick Company, 332 W. Huron Street, Chicago 10, Ill., which packs 25 yards of each in a container, or enough for 10 feet of 1-inch pipe. Free samples are available.

Aluminum-alloy pipe, made by the extrusion method, has been used for the first time in the construction of long-distance gas transmission lines. One, laid by the Alabama-Tennessee Natural Gas Company, is 9500 feet long and 8⅝ inches in diameter; the other, an underwater line built by the Lavaca Pipe Line Company, is 4000 feet long and 4 inches in diameter. Both are made up of 40-foot sections which, because of their lightness, were easily handled by two men. Being in the nature of an experiment, all the Alabama-Tennessee pipe, with the exception of one section, was wrapped with cold No-Oxid before being buried, while about half of the Lavaca line was coated and wrapped and the remainder left bare to test the effect of salt water on it.

Van Products Company has announced a new direct-acting machine vise of heavy construction powered by a single-acting pneumatic cylinder. Using air throughout a range of 15 to 150 psi., it exerts constant pressure from 0 to 5 tons and is designed to hold work of variable size in its 8⅜-inch-wide jaws that



open a maximum of 11 inches and have removable tool-steel faces ½ inch thick. Gap between jaws is preset by a standard socket-head wrench, and speed of opening and closing is adjustable. A stop screw is provided as a safety measure to prevent jaw movement beyond any fixed limit. The standard Model 811, as the new vise in the Vi-Speed line is designated, has a stroke of 1¼ inches. A special unit with a maximum stroke of 4 inches is available for pressing, shaping, forming, and similar operations.

Industrial Literature

A bibliography of books and articles published from 1924 to 1949 on the theory, design, and construction of foundations for machinery can be obtained from The Engineering Societies Library, 29 West 39th Street, New York 18, N. Y. The material listed deals with such specific problems as the building of heavy-machinery foundations on unstable soils and the vibration imparted to foundations by electrical machinery, turbines, oil and steam engines, compressors, machine tools, pumps, presses, etc. Price, $2.00.

Remington Rand, Inc., 315 Fourth Avenue, New York 10, N. Y., has published a booklet which describes its intermembered, interchangeable file cabinets that make it possible for any office to arrange its own file installation. Requests should be made for Booklet SC677.

Telling The Age of a United States Patent is the title of a folder obtainable upon request from Invention, Inc., Munsey Building, Washington 4, D. C. It lists the number of each patent, patent reissue, design, and trademark granted at the beginning of each calendar year from 1836 to 1950.

Gear-type tube benders are the subject of a bulletin obtainable from The Imperial Brass Manufacturing Company, 1200 West Harrison Street, Chicago 7, Ill. They are designed to handle copper, brass, aluminum, or steel tubing, including Bundy and thin-walled conduits, in sizes from ½ to 1⅛ inches outside diameter.

A folder obtainable from Norton Company, Worcester 6, Mass., describes its new reinforced resinoid grinding wheel that does both rough and finish grinding. Made in disk and hub shapes it can be fitted to any standard right-angle portable grinder and sander.

A compact, portable flow-meter kit for research, pilot-plant, and field work is described in a folder put out by Brooks Rotameter Company, Lansdale, Pa., and obtainable upon request. Weighing 15 pounds, it has a flow range for liquids from 0.1 cc. per minute to 0.5 gpm. and for air from 5 cc. per minute to 2 cfm.

Crane Packing Company will send free of charge a booklet descriptive of a machine that is designed to do flat lapping to extremely close tolerances on an automatic, high-production basis. It is intended for use in the manufacture of parts having precision surface flatness and finish. Request for the folder should be made to Department G-23, 1800 Cuyler Avenue, Chicago 13, Ill.

How manual effort can be reduced or eliminated, time saved, and economies effected through the application of air and hydraulic circuits to manufacturing processes is told in a booklet put out by Rivett Lathe & Grinder, Inc. A copy can be obtained by writing to the company at Brighton 35, Boston, Mass.

Charts that make it possible to quickly determine the proper size of valve required for a particular flow of liquid or gas have been prepared by Fischer & Porter Company, Hatboro, Pa. The one for liquids covers a range from 0.02 to 10,000 gpm., and the one for gas from 1 to 100,000 pounds per hour. Copies will be sent upon request.

Mercury-actuated clutches made by Automatic Steel Products, Inc., Canton 6,

Ohio, are described in three bulletins distributed by the company. No. 216 discusses the mercury clutch in general and lists various applications; No. 217 deals with clutches as applied to gasoline engines; and No. 218 covers electric-motor installations.

Spongex, a cellular rubber for insulation against shock, sound, vibration, moisture, and temperature changes, is the subject of a booklet put out by The Sponge Rubber Products Company, Shelton, Conn. It tells what the material is and lists and illustrates the stock forms and compositions available to meet a wide range of requirements. A copy will be sent upon request.

Literature on two new developments in compressor and diesel-engine fields can be had by writing to Ingersoll-Rand Company, 11 Broadway, New York 4, N. Y., or any of its branch offices. Form 3127-A describes a line of "packaged" gas engine-driven compressors in sizes from 110 to 220 hp. Form 10028-A deals with a lightweight diesel operating at 900-1000 rpm. in the 195- to 375-hp. range.

Sizes, ratings, specifications, and prices of safety heads and accessories are contained in a 16-page bulletin which Black, Sivalls & Bryson, Inc., 720 Delaware Street, Kansas City 6, Mo., will send upon request. Flanges, rupture disks, vacuum supports, refrigerant relief valves, pressure-vacuum vent valves, and combination vent valve-flame arrestor units are some of the products covered.

Bulletin AU250 just released by The Bellows Company describes its solenoid-controlled 4-way Electroaire valve and gives dimensional drawings and diagrams. A low-voltage unit of compact design, it permits installation in cramped quarters. A copy can be obtained from the company by writing to 222 W. Market Street, Akron, Ohio.

Information on more than 1000 kinds of atoms is given in the form of a wall chart prepared by General Electric Company. It is intended for the use of laboratories, colleges, universities, and similar institutions. A copy and an accompanying explanatory booklet will be mailed to persons addressing their request to Department 6-221, Schenectady 5, N. Y.

Johns-Manville, 22 East 40th Street, New York 16, N. Y., will send a 16-page handbook to anyone interested in nonmetallic oil seals. Containing data of use to engineers, designers, and maintenance men, the publication discusses the construction of the seals, lists their advantages in various applications, and gives installation and other information.

Those responsible for the storage and issuing of parts and stock items in manufacturing plants, tool cribs, and shipping rooms may be interested in a folder which describes rotary parts bins and other equipment and accessories that are designed to save floor space and cut manpower requirements. A copy can be had by writing to Frick-Gallagher Manufacturing Company, 401 Shubert Building, Philadelphia 2, Pa.

Totally enclosed fan-cooled motors in the 5- to 250-hp. range are the subject of a folder obtainable from Wagner Electric Corporation, 6400 Plymouth Avenue, St. Louis 14, Mo. Having cast-iron frames and available in both standard and explosion-proof designs, the units are especially suitable for use in chemical plants, oil fields, petroleum refineries, and other industrial establishments where corrosion is a problem.